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ABSTRACT

This book is intended to acquaint naval engineering officers with their duties in the engineering department. Standard shipboard organizations are analyzed in connection with personnel assignments, division operations, and watch systems. Detailed descriptions are included for the administration of directives, ship's bills, damage control, training exercises, shipboard maintenance, record and report systems, supply forms, engineering readiness and preparedness, gasoline and fuel oil stowage, and shipwork and repair activities during availabilities. Information concerning the procurement, laying up, and trial of ships is also included. Moreover, illustrations are provided for explanation use. (CC)

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ENGINEERING ADMINISTRATION

Prepared by
BUREAU OF NAVAL PERSONNEL

NAVPERS 10858-D

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1

PREFACE

The purpose of this book is to acquaint the prospective head of the engineering department and other officers of the department with the widely varied administrative duties of the engineer officer. This book and the sources of additional information mentioned in the text furnish much of the information necessary for the proper administration of the engineering department. This book is not intended as an official reference; if it is at variance with any official directive or doctrine publication, such directive or publication must apply. Current official directives and technical manuals should always be consulted for current information concerning the organization, responsibilities, and functions of the engineering department.

This book is based on the assumption that the reader, as a line officer, a limited duty (engineering) officer, or as an engineering duty officer, is familiar with the various aspects of marine engineering and appropriate technical material, and has acquired a general knowledge of the Naval Ships Technical Manual, as well as of Bureau of Naval Personnel texts relating to naval machinery and shipboard electrical systems.

Engineering Administration is used as the reference text for an officer correspondence course.

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2

THE UNITED STATES NAVY

GUARDIAN OF OUR COUNTRY

The United States Navy is responsible for maintaining control of the sea and is a ready force on watch at home and overseas, capable of strong action to preserve the peace or of instant offensive action to win in war.

It is upon the maintenance of this control that our country's glorious future depends; the United States Navy exists to make it so.

WE SERVE WITH HONOR

Tradition, valor, and victory are the Navy's heritage from the past. To these may be added dedication, discipline, and vigilance as the watchwords of the present and the future.

At home or on distant stations we serve with pride, confident in the respect of our country, our shipmates, and our families.

Our responsibilities sober us; our adversities strengthen us.

Service to God and Country is our special privilege. We serve with honor.

THE FUTURE OF THE NAVY

The Navy will always employ new weapons, new techniques, and greater power to protect and defend the United States on the sea, under the sea, and in the air.

Now and in the future, control of the sea gives the United States her greatest advantage for the maintenance of peace and for victory in war.

Mobility, surprise, dispersal, and offensive power are the keynotes of the new Navy. The roots of the Navy lie in a strong belief in the future, in continued dedication to our tasks, and in reflection on our heritage from the past.

Never have our opportunities and our responsibilities been greater.

3

CONTENTS

CHAPTER Page

1. The Engineer Officer 1
2. The Engineering Department 12
3. Damage Control 31
4. Training 53
5. Ship Maintenance 76
6. Records and Reports 96
7. Engineering Material 131
8. Engineering Standards 160
9. Fueling Ship 176
10. Ship Availabilities 186
11. Shipbuilding, Inactivation, and Activation 211
12. Ship Trials 224

INDEX 232

CHAPTER 1

THE ENGINEER OFFICER

One of the most interesting, challenging, and rewarding jobs in a naval ship is that of the head of the engineering department—the engineer officer. It is not possible for every unrestricted line officer desiring a naval career to serve a tour of duty as engineer officer, but each one should serve at least one tour of duty in the engineering department of a ship. This is especially true today when the complexities of modern techniques of naval warfare demand that the commanding officer possess complete knowledge of his ship's operating capabilities. Normally, the assignment as head of the engineering department in a naval ship requires prior shipboard engineering plant experience, preferably as an officer. In an emergency, however, when the need for engineer officers exceeds the availability of those with prior experience, a young officer with an engineering background may be assigned duty as engineer officer of a small ship.

This chapter is devoted primarily to a discussion of standard shipboard organization and the duties, responsibilities, and authority of the engineer officer. Throughout this chapter and in subsequent chapters of this publication some of the duties of the engineer officer are related as they apply to his assistants when assigned. It must be understood, however, that the delegation of certain of his duties to assistants in no way relieves the engineer officer of his responsibility in regard to such duties and when no assistants are assigned, the engineer officer must perform those duties himself.

STANDARD SHIP ORGANIZATION

Organization is the orderly arrangement of materials and personnel by functions. Sound shipboard organization is a requisite for good shipboard administration. A shipboard organization, designed to carry out the objectives of command, is based on a division of activities and on the assignment of responsibilities and authority to individuals within the organization. To ensure optimum efficiency within the organization, all essential functions must be recognized and delineated as specific responsibilities of appropriate organizational units, and there must be a clear definition of individual duties, responsibilities, and authority.

The responsibility for organization of the officers and crew of a ship is assigned to the commanding officer by U.S. Navy Regulations. The executive officer is responsible, under the commanding officer, for organization of the command as a whole, while the heads of departments are assigned the duty of organizing their departments for readiness in battle and assigning individuals to stations and duties within their respective departments.

The requirements for battle form the basis for the organization of combat ships and, as appropriate, for the organization of noncombatant ships. Functional groups such as those shown in figure 1-1 are headed by key officers and comprise the battle organization of such ships. The officers man specified stations and control the activities of personnel under their direction. Functional group control contributes flexibility to the battle organization thereby increasing its effectiveness when executing the plan for battle or variations thereof necessitated by the tactical situation.

The commanding officer as head of the battle organization exercises command control and is responsible, during action, for engaging the enemy to the best of his ability. The commanding officer is assisted in his tasks by the navigator, operations officer, weapons officer (or first lieutenant), engineer officer, damage control assistant, air officer (aircraft carriers), and the combat cargo officer (amphibious operations), all of whom have cognizance over the

5

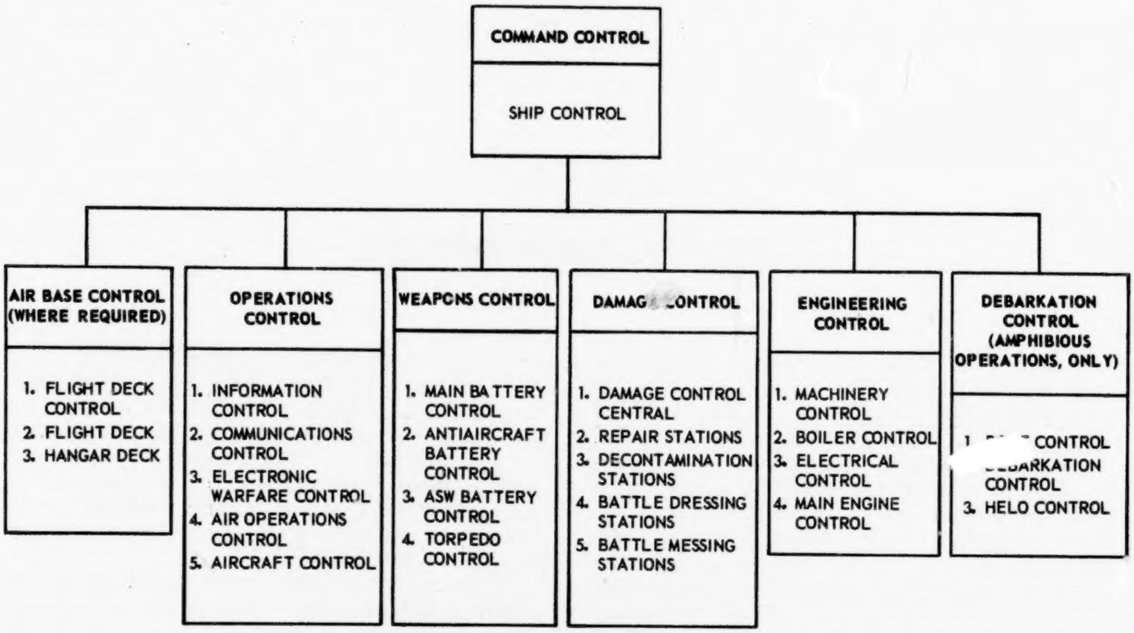

COMMAND CONTROL
SHIP CONTROL
AIR BASE CONTROL (WHERE REQUIRED)
1. FLIGHT DECK CONTROL
2. FLIGHT DECK
3. HANGAR DECK
OPERATIONS CONTROL
1. INFORMATION CONTROL
2. COMMUNICATIONS CONTROL
3. ELECTRONIC WARFARE CONTROL
4. AIR OPERATIONS CONTROL
5. AIRCRAFT CONTROL
WEAPONS CONTROL
1. MAIN BATTERY CONTROL
2. ANTIAIRCRAFT BATTERY CONTROL
3. ASW BATTERY CONTROL
4. TORPEDO CONTROL
DAMAGE CONTROL
1. DAMAGE CONTROL CENTRAL
2. REPAIR STATIONS
3. DECONTAMINATION STATIONS
4. BATTLE DRESSING STATIONS
5. BATTLE MESSING STATIONS
ENGINEERING CONTROL
1. MACHINERY CONTROL
2. BOILER CONTROL
3. ELECTRICAL CONTROL
4. MAIN ENGINE CONTROL
DEBARKATION CONTROL (AMPHIBIOUS OPERATIONS, ONLY)
1. [illegible] CONTROL
[illegible]BARKATION CONTROL
3. HELO CONTROL

Figure 1-1.—Shipboard battle organization. 114.1

major control functions of the ship in battle. The functions (fig. 1-1) include ship control, operations control, weapons control, engineering control, damage control, air base control, and debarkation control. When embarked, the air group commander is responsible to the commanding officer in matters affecting the air group's readiness.

Additional information concerning shipboard battle organization is available in Battle Control (U), NWIP 50-1(B). Information concerning the damage control battle organization is contained in chapter 3 of this publication.

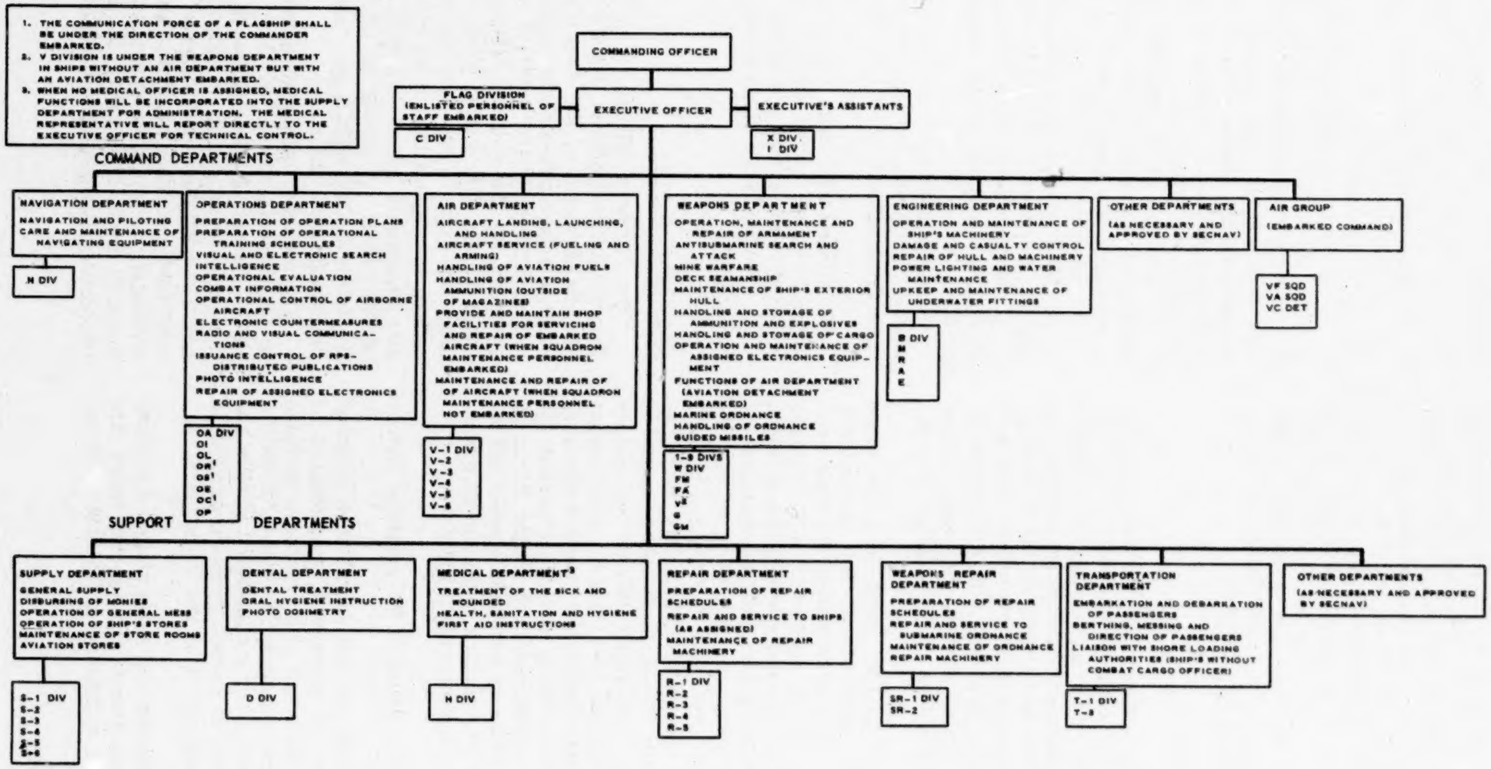
In many departments, the division of personel in the shipboard administrative organization (fig. 1-2) closely approximates that in the shipboard battle organization. However, to meet the requirements of sound organization principles, the administrative organization structure must allow for the carrying out of certain functions which have no place in battle. In the day-to-day routine, the needs of training and maintenance are emphasized, and certain support measures are necessary for administrative reasons.

U.S. Navy Regulations prescribes the administrative organization for all types of ships. The navigation department, operations department, weapons department (deck department in some ships), engineering department, and supply department are the five basic departments found in all ships. An officer may be assigned to head more than one department in ships which do not have a sufficient number of officers to head each department individually.

Departments are organized into divisions which, insofar as practicable, are assigned battle stations permitting their employment as units under their own officers and petty officers. Shipboard Procedures, NWP-50(A), lists the standard letter and numeral designations of divisions of all types of ships. When it is necessary to establish a division not listed or when functions of two or more divisions are combined in a single division, the type commander assigns a suitable letter or numeral designation which conforms as nearly as possible to the designations listed. Examples of the division designations are shown in figure 1-2.

HEAD OF ENGINEERING DEPARTMENT

The engineer officer is the head of the engineering department in naval ships. As a head of department, the engineer officer represents the commanding officer in all matters pertaining to his department. All personnel in the engineering department are subordinate to the engineer officer and all orders issued by him must be


COMMANDING OFFICER
EXECUTIVE OFFICER
FLAG DIVISION (ENLISTED PERSONNEL OF STAFF EMBARKED)
C DIV
EXECUTIVE'S ASSISTANTS
X DIV
I DIV
COMMAND DEPARTMENTS
NAVIGATION DEPARTMENT
NAVIGATION AND PILOTING
CARE AND MAINTENANCE OF NAVIGATING EQUIPMENT
N DIV
OPERATIONS DEPARTMENT
PREPARATION OF OPERATION PLANS
PREPARATION OF OPERATIONAL TRAINING SCHEDULES
VISUAL AND ELECTRONIC SEARCH
INTELLIGENCE
OPERATIONAL EVALUATION
COMBAT INFORMATION
OPERATIONAL CONTROL OF AIRBORNE AIRCRAFT
ELECTRONIC COUNTERMEASURES
RADIO AND VISUAL COMMUNICATIONS
ISSUANCE CONTROL OF RPS-DISTRIBUTED PUBLICATIONS
PHOTO INTELLIGENCE
REPAIR OF ASSIGNED ELECTRONICS EQUIPMENT
OA DIV
OI
OL
OR¹
OS¹
OE
OC¹
OP
AIR DEPARTMENT
AIRCRAFT LANDING, LAUNCHING, AND HANDLING
AIRCRAFT SERVICE (FUELING AND ARMING)
HANDLING OF AVIATION FUELS
HANDLING OF AVIATION AMMUNITION (OUTSIDE OF MAGAZINES)
PROVIDE AND MAINTAIN SHOP FACILITIES FOR SERVICING AND REPAIR OF EMBARKED AIRCRAFT (WHEN SQUADRON MAINTENANCE PERSONNEL EMBARKED)
MAINTENANCE AND REPAIR OF OF AIRCRAFT (WHEN SQUADRON MAINTENANCE PERSONNEL NOT EMBARKED)
V-1 DIV
V-2
V-3
V-4
V-5
V-6
WEAPONS DEPARTMENT
OPERATION, MAINTENANCE AND REPAIR OF ARMAMENT
ANTISUBMARINE SEARCH AND ATTACK
MINE WARFARE
DECK SEAMANSHIP
MAINTENANCE OF SHIP'S EXTERIOR HULL
HANDLING AND STOWAGE OF AMMUNITION AND EXPLOSIVES
HANDLING AND STOWAGE OF CARGO
OPERATION AND MAINTENANCE OF ASSIGNED ELECTRONICS EQUIPMENT
FUNCTIONS OF AIR DEPARTMENT (AVIATION DETACHMENT EMBARKED)
MARINE ORDNANCE
HANDLING OF ORDNANCE
GUIDED MISSILES
1-9 DIVS
W DIV
FM
FA
V²
G
GM
ENGINEERING DEPARTMENT
OPERATION AND MAINTENANCE OF SHIP'S MACHINERY
DAMAGE AND CASUALTY CONTROL
REPAIR OF HULL AND MACHINERY
POWER LIGHTING AND WATER MAINTENANCE
UPKEEP AND MAINTENANCE OF UNDERWATER FITTINGS
B DIV
M
R
A
E
OTHER DEPARTMENTS (AS NECESSARY AND APPROVED BY SECNAV)
AIR GROUP (EMBARKED COMMAND)
VF SQD
VA SQD
VC DET
SUPPORT DEPARTMENTS
SUPPLY DEPARTMENT
GENERAL SUPPLY
DISBURSING OF MONIES
OPERATION OF GENERAL MESS
OPERATION OF SHIP'S STORES
MAINTENANCE OF STORE ROOMS
AVIATION STORES
S-1 DIV
S-2
S-3
S-4
S-5
S-6
DENTAL DEPARTMENT
DENTAL TREATMENT
ORAL HYGIENE INSTRUCTION
PHOTO DOSIMETRY
D DIV
MEDICAL DEPARTMENT³
TREATMENT OF THE SICK AND WOUNDED
HEALTH, SANITATION AND HYGIENE
FIRST AID INSTRUCTIONS
H DIV
REPAIR DEPARTMENT
PREPARATION OF REPAIR SCHEDULES
REPAIR AND SERVICE TO SHIPS (AS ASSIGNED)
MAINTENANCE OF REPAIR MACHINERY
R-1 DIV
R-2
R-3
R-4
R-5
WEAPONS REPAIR DEPARTMENT
PREPARATION OF REPAIR SCHEDULES
REPAIR AND SERVICE TO SUBMARINE ORDNANCE
MAINTENANCE OF ORDNANCE REPAIR MACHINERY
SR-1 DIV
SR-2
TRANSPORTATION DEPARTMENT
EMBARKATION AND DEBARKATION OF PASSENGERS
BERTHING, MESSING AND DIRECTION OF PASSENGERS
LIAISON WITH SHORE LOADING AUTHORITIES (SHIP'S WITHOUT COMBAT CARGO OFFICER)
T-1 DIV
T-2
OTHER DEPARTMENTS (AS NECESSARY AND APPROVED BY SECNAV)

1. THE COMMUNICATION FORCE OF A FLAGSHIP SHALL BE UNDER THE DIRECTION OF THE COMMANDER EMBARKED.
2. V DIVISION IS UNDER THE WEAPONS DEPARTMENT IN SHIPS WITHOUT AN AIR DEPARTMENT BUT WITH AN AVIATION DETACHMENT EMBARKED.
3. WHEN NO MEDICAL OFFICER IS ASSIGNED, MEDICAL FUNCTIONS WILL BE INCORPORATED INTO THE SUPPLY DEPARTMENT FOR ADMINISTRATION. THE MEDICAL REPRESENTATIVE WILL REPORT DIRECTLY TO THE EXECUTIVE OFFICER FOR TECHNICAL CONTROL.

27.1

Figure 1-2.—Shipboard administrative organization.

obeyed accordingly by them. In the performance of his duties as head of the engineering department, he must conform to the policies and comply with the orders of the commanding officer. In addition to general duties which are applicable to all heads of departments in naval ships, the engineer officer has certain duties peculiar to the head of the engineering department. The duties, responsibilities, and authority of the engineer officer and his assistants are prescribed in U.S. Navy Regulations.

GENERAL DUTIES

The engineer officer is allowed to confer directly with the commanding officer in any matters relating to the engineering department whenever he believes such action to be necessary for the good of his department or the naval service. He must keep the executive officer informed of such matters, however, and will normally report to and confer with the executive officer for the administration of the engineering department.

The engineer officer must keep the commanding officer informed of the operational readiness and actual operation of the main propulsion and electrical plants and of the damage control organizations and systems. Permission of the commanding officer must be obtained before any machinery or equipment in the engineering department can be disabled if such action will adversely affect the safety or operation of the ship. When such disablement of machinery will adversely affect the ship's ability to accomplish her mission, permission of the type or fleet commander (as appropriate) is also required. During operating periods of the ship, the disablement of major items of machinery in order to perform routine maintenance should be kept to a minimum commensurate with good engineering practices.

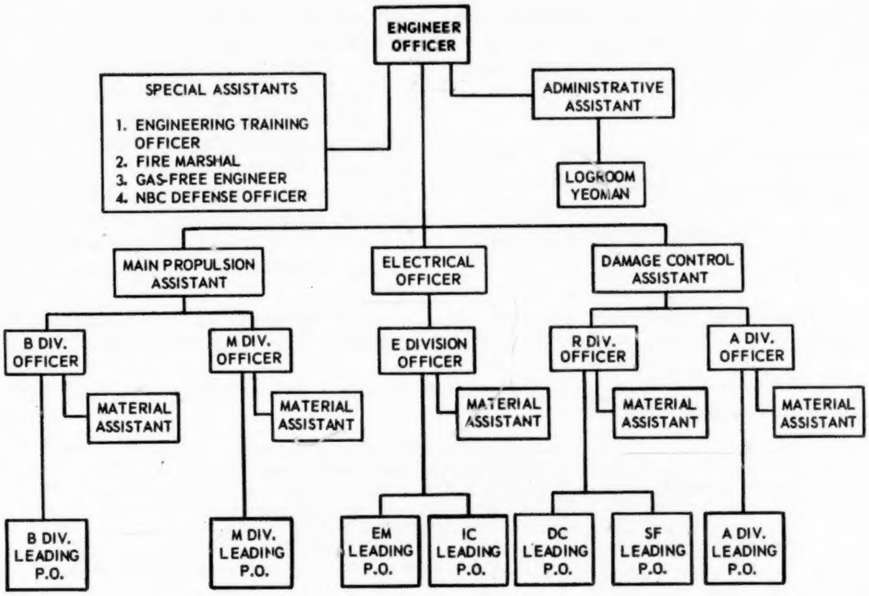
Other general duties of the engineer officer include:

1. Organization of the department, training and assignment of personnel, maintenance of material, and exercise of a readiness doctrine so as to ensure optimum readiness for battle.
2. Preparation and maintenance of bills and orders necessary to ensure proper organization and efficient operation of the engineering department.
3. Indoctrination and supervision of persons within the department and others under his control in such a manner as to ensure strict observance of all prescribed and necessary security measures and safety precautions. This requires proper posting of all safety precautions and frequent instruction of personnel concerned in observance of security measures and safety precautions.
4. Conducting frequent inspections of personnel, material, and spaces assigned to the engineering department and correction of defects and deficiencies. The engineer officer or his representative should inspect the department each day and report results of the inspection to the executive officer.
5. Control of the expenditure of funds allotted and operation of the engineering department within the limit of such funds.
6. Economy in the use of public funds.
7. Maintenance of records and submission of reports required of the engineering department.
8. Maintenance, preservation, and security of spaces assigned to the engineering department.
9. Anticipation of personnel and material needs of the engineering department and the timely submission of requests to fulfill requirements.
10. Cooperation with other heads of departments in order to contribute to the coordination of effort of the entire command.
11. Performance of such other duties as may be assigned.

SPECIFIC DUTIES

The engineer officer is responsible, under the commanding officer, for the operation, care, and maintenance of the ship's main propulsion plant, electric power plant, auxiliary machinery, piping systems, and interior communications systems; for the control of damage; and for repairs to the ship's hull. When requested by the head of department concerned, the engineer officer is responsible for the repairs to material and equipment which are beyond the capacity of the repair personnel or equipment in other departments but within the capacity of the engineering department.

The engineer officer assigned to a ship prior to its commissioning will have the task of initially organizing his department, and even though the engineer officer in an older ship usually inherits an efficient and well-run department, he may find a certain amount of reorganization is necessary to improve operation of the department. In either eventuality, the engineer officer is specifically charged with administratively or-


ENGINEER OFFICER
SPECIAL ASSISTANTS
1. ENGINEERING TRAINING OFFICER
2. FIRE MARSHAL
3. GAS-FREE ENGINEER
4. NBC DEFENSE OFFICER
ADMINISTRATIVE ASSISTANT
LOGROOM YEOMAN
MAIN PROPULSION ASSISTANT
ELECTRICAL OFFICER
DAMAGE CONTROL ASSISTANT
B DIV. OFFICER
M DIV. OFFICER
E DIVISION OFFICER
R DIV. OFFICER
A DIV. OFFICER
MATERIAL ASSISTANT
MATERIAL ASSISTANT
MATERIAL ASSISTANT
MATERIAL ASSISTANT
MATERIAL ASSISTANT
B DIV. LEADING P.O.
M DIV. LEADING P.O.
EM LEADING P.O.
IC LEADING P.O.
DC LEADING P.O.
SF LEADING P.O.
A DIV. LEADING P.O.

27.2

Figure 1-3.—Typical engineering department.

ganizing the engineering department in such a manner that the indoctrination, assignment, training, supervision, and performance of personnel within the department will ensure effective, efficient, and reliable operation of the ship's engineering plant and damage control facilities.

Before maximum efficiency of operation is possible, all hands in the engineering department must have a clear understanding of the functional relationships within the department's organization. Duties, responsibilities, authority, and organizational relationships must be clearly understood or costly confusion and conflict will develop. Organization charts and functional guides furnish the best means of making the details of an organization known.

Organization charts show the arrangement of the various departments and divisions and the command and staff relationships of personnel in the organization. An engineering department organization chart (similar to the one shown in fig. 1-3) illustrating the relationship between the engineer officer, his assistants, division officers, material officers, and leading petty officer billets should be maintained in the engineering department office (log room) for the engineering department.

There are two commonly used types of organization charts. A structural organization chart (fig. 1-3), which outlines the basic relationships between the various components of the organization, is a simple presentation of the line and staff relationships of executive officer and supervisory leading petty officer billets in the organization. A functional organization chart presents the functions of the various segments of the organization in addition to indicating the interrelationships of those functions. Within the various boxes of a functional organization chart are included statements applicable to the organizational segments represented by the box.

The chief advantage of an organization chart is that it provides all personnel in an organization with a concise picture of the relationships of individuals within the organization. In a large organization, charts should be prepared for each level, becoming more detailed as they illustrate smaller segments of the organization. In smaller commands, charts of only the department organization may suffice to illustrate the details of all executive and supervisory positions.

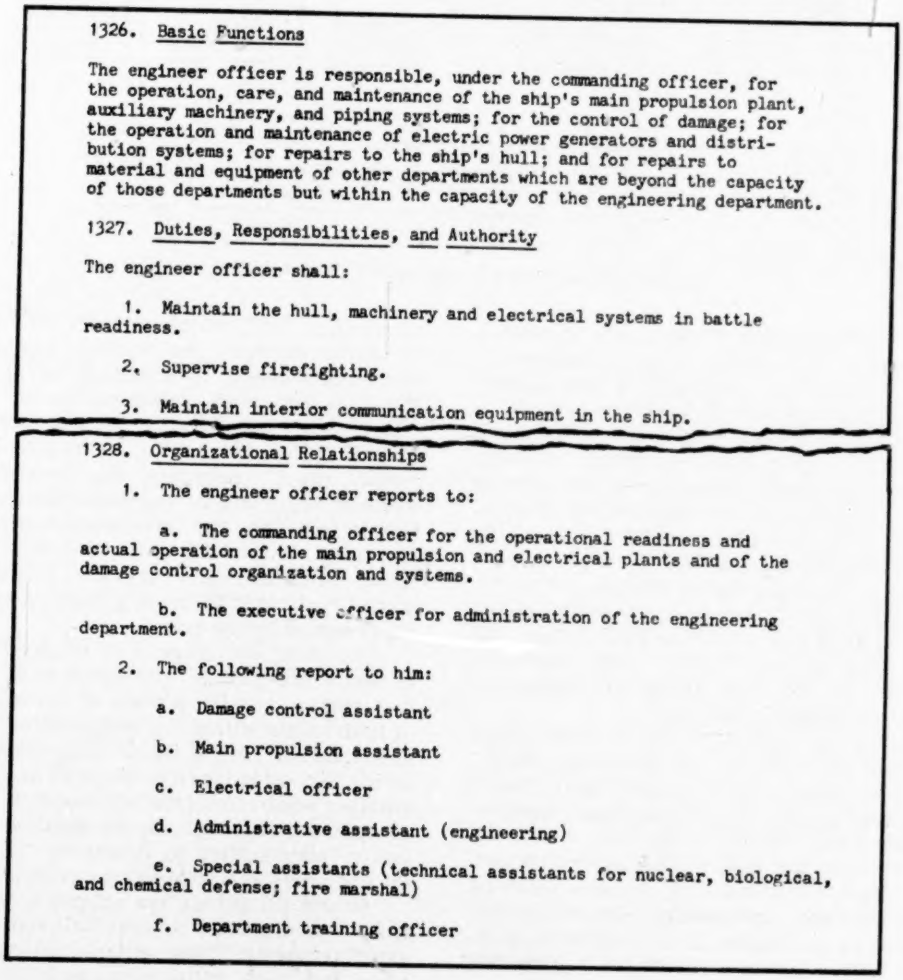
Functional guides are primarily job descriptions which present a clear delineation of delegated authority. These guides set forth instructions for each billet concerning the basic objective of the billet; the duties, responsibilities, and authority applicable to the billet; and the organizational relationships defining the accountability of the incumbent to his supervisor and of the subordinates to the incumbent. The format of a sample functional guide is shown in figure 1-4.

Ship organization and regulations manuals provide organization charts and functional guides to ship's personnel in an easily referenced form. The Ship's Organization and Regulations Manual includes, as a minimum requirement, the following:

1. Description, both written and graphic, of the ship's administrative organization from the commanding officer level and of the watch organization through all echelons.
2. Organizational bill of the ship.
3. Ship's regulations.

When determined necessary by the type commander, the ship's organization and regulations manual is supplemented by department and division organization manuals containing organization charts and functional guides through all supervisory levels. Where appropriate, functional guides are also provided for watch standers.

The engineer officer and engineering division officers are responsible for issuing and main-



1326. Basic Functions

The engineer officer is responsible, under the commanding officer, for the operation, care, and maintenance of the ship's main propulsion plant, auxiliary machinery, and piping systems; for the control of damage; for the operation and maintenance of electric power generators and distribution systems; for repairs to the ship's hull; and for repairs to material and equipment of other departments which are beyond the capacity of those departments but within the capacity of the engineering department.

1327. Duties, Responsibilities, and Authority

The engineer officer shall:

1. Maintain the hull, machinery and electrical systems in battle readiness.

2. Supervise firefighting.

3. Maintain interior communication equipment in the ship.

1328. Organizational Relationships

1. The engineer officer reports to:

a. The commanding officer for the operational readiness and actual operation of the main propulsion and electrical plants and of the damage control organization and systems.

b. The executive officer for administration of the engineering department.

2. The following report to him:

a. Damage control assistant

b. Main propulsion assistant

c. Electrical officer

d. Administrative assistant (engineering)

e. Special assistants (technical assistants for nuclear, biological, and chemical defense; fire marshal)

f. Department training officer

114.2

Figure 1-4.—Format for a functional guide.

taining their respective department or division organization manuals. The commanding officer must approve the engineering department organization manual when issued, and the engineer officer must approve any division organization manuals issued for divisions under his cognizance. Detailed instructions concerning the preparation of department and division organization manuals are contained in Shipboard Procedures, NWP-50(A).

Other specific duties of the engineer officer are discussed in detail under the duties of his assistants in this chapter and in subsequent chapters.

ASSISTANTS TO THE ENGINEER OFFICER

The engineer officer is assigned assistants for damage control, main propulsion, electrical, and other specific duties as may be required for the proper performance of the functions of the engineering department. The duties prescribed for the engineer officer do not relieve his assistants of their responsibilities. The engineer officer will ensure that his assistants perform their assigned duties and he is required to perform those specific duties himself, when assigned.

Damage Control Assistant

The damage control assistant (DCA) is responsible, under the engineer officer, for the establishment and maintenance of an effective damage control organization; for the supervision of repairs to the ship's hull, machinery, and piping systems except as specifically assigned to another division or department; for the operation and maintenance of assigned auxiliary machinery; and for the preparation, maintenance and submission of logs, records, and reports required in connection with his assigned functions. The specific duties of the damage control assistant are discussed in considerable detail in chapter 3 of this publication.

Normally, the auxiliaries (A) and repair (R) division officers are responsible under the damage control assistant. The damage control assistant performs the duties of the R and A division officers in ships where the number of officers assigned precludes the assignment of these billets to other officers.

Main Propulsion Assistant

The main propulsion assistant is responsible under the engineer officer for the operation, care and maintenance of the ship's propulsion machinery, the auxiliaries related thereto, and such other auxiliaries as may be assigned.

Under the engineer officer, the main propulsion assistant is specifically responsible for the reliability and effective operation of the ship's main engines, boilers and assigned auxiliaries. In the discharge of these duties, he must make, or cause reliable subordinates to make, frequent inspections of all the machinery and equipment for which he is responsible. In addition, the main propulsion assistant must ensure the reliability of such machinery and equipment by making certain that necessary inspections, tests, repairs, and adjustments are effected subject to receipt of required authorization and in accordance with applicable Naval Ship Systems Command and manufacturer's technical manuals. He must personally supervise the operation of the main propulsion plant when the ship is getting underway, coming to anchor, and at other times when unusual care must be exercised. Except in cases of emergency, he must ensure that permission of the commanding officer is obtained before fires are lighted or secured under a boiler, and that main engines are not turned except upon signal from, or permission of, the officer of the deck.

Other engineering duties of the main propulsion assistant include:

1. The care, stowage, and expenditure of fuels (except for aircraft and missiles); the maintenance and security of fueling systems (except for aircraft and missiles); and the maintenance of fuel records including submission of a daily fuel report to the commanding officer via the engineer officer.
2. Proper preparation, care, submission, and disposition of the engineering log and engineer's bell book. In this regard, he is required to inspect them at least daily and take such action as may be necessary, within the limits of his authority, to ensure their proper maintenance and timely submission.
3. The preparation, care, and disposition of such operation, maintenance, and other engineering records as may be prescribed by the Naval Ship Systems Command or other competent authority.

The main propulsion assistant must know the operation characteristics of the equipment and machinery concerned in order to be able to properly observe tests and interpret their results; to properly inspect spaces, machinery, and equipment; and to obtain useful (and often vital) information from the perusal of logs, records, and reports. Naturally, there is no substitute for experience but since available time often precludes the opportunity for the necessary experience, the main propulsion assistant must avail himself of every opportunity of improving his knowledge of machinery and equipment through self-study and attendance (when practicable) at fleet operated schools.

The main propulsion assistant can gain considerable self-confidence and knowledge by qualifying himself (and requiring that each of his watch officers qualify) in the procedures for warming up and securing each major item of machinery in the main engineering plant. The training may be conducted by a previously qualified officer or the most competent engineering petty officers. This training should improve the efficiency and morale of both the watch officer and the personnel of his watch.

Information concerning the equipment and machinery in his own ship is available to the main propulsion assistant in publications such as blueprints and manufacturers' technical manuals which are readily available in the log room. Two of the most important reference books in the engineering department are the Naval Ships Technical Manual and the Ship Information Book. Information concerning the location, condition, size, and description of the machinery and equipment in the engineering department is easily obtainable by actually sighting the equipment and machinery during operation, when idle, and while maintenance procedures are being performed. Manufacturer's name plates attached to equipment show data concerning safe operating limits, capacities, and other useful information.

To the more knowledgeable officer, comparison of past and present performance records, reports, and logs will present a clear picture of the condition of the engineering plant and will often disclose areas of suspect or the actual need of repairs. Evaluation of information gained from this source must necessarily be based upon the completeness of the records, reports, and logs, and the integrity of the person or persons who prepared them.

A valuable source of knowledge which should never be overlooked is the information available from more experienced officers, supervisors, and equipment operators. The supervisor of a space should always accompany the main propulsion assistant on his inspection tour. In this manner, the supervisor is readily available to answer questions and receive orders concerning the space and machinery.

In ships where the number of officers available does not permit the assignment of other officers as the main engines (M) and boiler (B) division officers, the main propulsion assistant may also be assigned these billets. The M and B division officers are responsible under the main propulsion assistant, when assigned.

Electrical Officer

The electrical officer is responsible, under the engineer officer, for the operation, care and maintenance of the ship's electric power generators and distribution systems, interior communications equipment and systems, degaussing equipment and systems, gyro compass equipment and associated systems, dead reckoning analyzer and associated equipment, and small boat electrical systems. He is also responsible for the maintenance of all other electrical and electronic equipment, machinery and systems not specifically assigned to another division or department; and the preparation, maintenance, and submission of logs, records, and reports required in connection with his assigned duties.

The electrical officer is usually assigned collateral duty as motion picture officer. In this capacity, he is responsible for the procurement, stowage, scheduling, and showing of entertainment motion picture programs; for the training and assignment of motion picture projectionists; for the operation, care, and maintenance of motion picture projectors and associated equipment; and for the preparation, maintenance, and submission of the required logs, records, and reports concerning motion picture programs and equipment.

When an electrical officer is not assigned, his duties are usually performed by the damage control assistant. The electrical (E) division officer is responsible under the electrical officer

Engineering Administrative Assistant

The engineering department administrative assistant functions as an aide to the engineer officer in the details of administration. When assigned, the engineering administrative assistant is responsible for:

1. Operation of the log room, maintenance of the equipment assigned, and the maintenance and preservation of the space assigned.

2. Assignment, training, supervision, and evaluation of the log room yeomen and other enlisted personnel assigned to the log room.
3. Maintenance of the engineering department records and a tickler file on all required reports.
4. Preparation of the engineering department watch bills.

The engineering administrative assistant screens all incoming engineering department correspondence, initiates required action (when appropriate), and checks the accuracy of all correspondence leaving the department. He assists the engineer officer in the implementation of directives from higher authority that pertain to the administration of the engineering department. He also assists in the preparation of all engineering department directives and (following release by the engineer officer) exercises control over their issuance in such a manner as to assure effective dissemination.

Supervision of the log room must not be neglected. The operation of this office affects each of the engineering divisions and reflects the effectiveness of the engineering department. Blueprints, technical manuals, and other publications must be properly stowed and indexed so they can be easily located. A method must be established for accounting for publications which have been removed from the log room and their removal should be kept to a minimum. Periodic inventories must be held so that missing items can be promptly reordered. Changes should be entered as soon as possible in order to ensure the publications are maintained up to date. Logs, records, and reports should be properly filed for easy reference. In order to avoid clutter in the log room, a plan must be established for the prompt disposition of logs, records, and reports in accordance with current applicable instructions.

In some ships the duties of the engineering administrative assistant may be assigned to the main propulsion assistant.

Engineering Training Officer

The engineering department training officer is an assistant to the engineer officer for the administration and coordination of the training program of the engineering department. The duties, responsibilities, and authority of the engineering training officer are discussed in detail in chapter 4 of this publication.

NBC Defense Officer

The nuclear, biological, and chemical (NBC) defense officer should be a graduate of a comprehensive NBC defense course or a chemical-biological defense course. Generally, the job of NBC defense officer is assigned as collateral duty to the damage control assistant. In this capacity he acts as technical advisor to the commanding officer and the engineer officer in matters concerning NBC defense. He assists division officers in the NBC warfare training of personnel in the ship and is responsible for the indoctrination and training of the damage control battle organization in this type of warfare. The specific duties of the damage control assistant prior to and following an NBC attack are discussed in detail in chapter 3 of this publication.

Gas-Free Engineer

The Naval Ship Systems Command requires that each naval ship which may have occasion to order men into closed or poorly ventilated spaces or to perform hot work in the vicinity of explosive or flammable materials, designate one competent person gas-free engineer. The term "hot work" as used in this publication includes all work involving the use of open flame or spark producing equipment or any work involving heating metal to or above 450°F. The gas free engineer, usually subordinate to the damage control assistant, must analyze conditions in his ship and ensure that no danger of suffocation of personnel or hazard to personnel or equipment from noxious or explosive gases exists during any operations in the ship. He advises the engineer officer and commanding officer in matters concerning the safety of personnel performing welding and allied work in hazardous locations. He assists the engineer officer in the preparation of instructions regarding entry into closed or poorly ventilated spaces and the procedures to be followed to ensure the safety of personnel and equipment involved in welding and allied operations.

The gas-free engineer must organize and administer a training program to inform all hands of the hazards involved in entering closed or poorly ventilated spaces and in welding and allied operations. He is responsible for the posting of warnings of such hazards in spaces where they exist and he is authorized to order men out of a compartment immediately or to suspend work whenever an unsafe condition is found to exist. He must immediately notify the commanding officer, engineer officer, or other responsible authority, of any such cessation of work and the reasons therefore.

The gas-free engineer will be governed in the performance of his duties by applicable instructions contained in NavShips Technical Manual; the commanding officer's instructions; and other directives issued by higher authority. In many ships the damage control assistant is assigned collateral duty as gas-free engineer. When the gas-free engineer is an officer other than the damage control assistant, he shall keep the damage control assistant informed of matters concerning his duties.

It should be noted that the designation of the gas-free engineer by the ship's commanding officer is a matter of logics. The commanding officer knows the requirements of this collateral duty and normally designates a person who best possesses these qualifications.

The Damage Control Schools in Philadelphia and Treasure Island cover the use of explosive and noxious vapor detectors, use of proper ventilation, use of air line masks and oxygen breathing apparatus, safety precautions and fire hazards in closed unventilated spaces. Depending upon what course the student is taking in these schools, he is exposed to varying amounts of the NavShips requirements (which are periodically prescribed by NavShips through the Bureau of Naval Personnel for activities afloat) for the gas-free engineer. The schools do not actually train the gas-free engineer.

The aforementioned logics are that aboard each ship several men, such as the engineer officer, the DCA, and the senior Damage Controlman, have been trained in the requirements, recommended by NavShips, to various degrees. At present, the commanding officer designates the person who will most logically posses this background and who is trustworthy enough to learn what he doesn't know, and who possesses sufficient initiative and leadership ability to carry out the duties regarding the safety of the ship and men working in closed spaces that may contain death-dealing vapors or a lack of oxygen.

Fire Marshal

The fire marshal is responsible under the engineer officer for the maintenance, availability, and reliability of the firefighting equipment in the ship; and for the elimination of fire hazards. He assists the damage control assistant in the preparation and administration of the training of personnel in the ship's damage control battle organization. He must also keep the damage control assistant informed of his actions as fire marshal.

PROSPECTIVE ENGINEER OFFICER

Usually when an officer reports to a ship in commission to relieve the engineer officer, the relief is effected jointly by the two officers concerned. At other times, an officer may be assigned to a ship prior to its commissioning for duty on board as engineer officer when commissioned. In the former case, the job of the officer prior to relieving the engineer officer is relatively simple and much assistance can be obtained from the incumbent himself.

The circumstances are quite different when an officer is ordered to duty as the prospective engineer officer of a ship to be commissioned. In this case, he performs the duties of engineer officer subject to the orders of the officer to whom he has reported for duty (shipyard commander, supervisor of shipbuilding, or reserve fleet group commander). If his ship is being constructed, he will have the task of initially organizing the engineering department as well as establishing and maintaining working relations with shipyard personnel; attending to the numerous details concerning inspection of machinery, tests, trials, and equipage; preparing casualty control and repair party manuals, operating instructions, and safety precautions; selecting personnel for certain jobs; training assigned personnel; and performing the many other details peculiar to a new ship prior to commissioning. The job will be less complicated if the ship has been in commission previously, as in the case of a major conversion or a reactivated ship.

In any event, the job of the prospective engineer officer will be a much easier task if he has had previous experience in the engineering department of a naval ship. If he has not already done so, one of the first things he should do is prepare a check list of all required publications, logs, records, and reports. Such a list is helpful when organizing the engineering department as well as when determining that the publications, logs, records, and reports of the engineering department of a ship in commission are complete, correct, and up to date prior to effecting relief of the engineer officer. Naval Ships Technical Manual, Shipboard Procedures, NWP-50(A); Battle Control (U), NWIP-50-1(B); U.S. Navy Regulations; Navy Department instructions and notices; Naval Ship Systems Command directives; and the type commander's directives are publications which will be of aid in the preparation of such a check list.

DUTIES UPON DETACHMENT

When the engineer officer of a ship is ordered detached from such duty, he and his relief must jointly inspect the material, and records of the engineering department. Upon completion of the inspection, the two officers submit a joint report to the commanding officer. The report lists any defects or deficiencies, describes the status of transfer of the equipage charged to the department or subdivision (not required in organizations where equipage is held in the Plant Account) and states the facts in dispute when there is any disagreement between the officers as to the condition revealed by the inspection. In the event of disagreement, the commanding officer ascertains the actual conditions, fixes responsibility for them, and takes such other action as may be necessary.

During the joint inspection of the engineering department, the relieving officer should:

1. Inspect operation of the engineering plant at anchor and underway (if possible).
2. Investigate any recent engineering casualties.
3. Inspect all spaces for cleanliness, preservation, and posting of safety precautions and operating instructions.
4. Check the job orders accomplished during the last regular overhaul.
5. Check the status of authorized alterations and outstanding shipyard, and tender or repair ship work requests.
6. Observe the actions of watch personnel during casualty drills.
7. Check feed water and fuel consumption.
8. Inspect and observe operation of the damage control battle organization (if practicable).
9. Inventory damage control lockers.
10. Check the routine for handling correspondence and note any outstanding correspondence requiring action.
11. Check the status of required engineering exercises to determine outstanding requirements.
12. Inspect engineering department shop operations.

The relieving officer should review the personnel records of engineering department personnel as to the number assigned, their qualifications, and assignments. He should inspect all personnel of the department at quarters at least one time prior to effecting relief. He must include a statement in his relieving letter as to whether sufficient qualified engineering department personnel are on board and list any shortages.

Prior to effecting relief of the engineer officer, the relieving officer should acertain that all required logs, records, publications, and reports are being maintained and are correct, complete, and up to date. Any discrepancies found must be noted in his relieving letter.

In order to ascertain the amount and condition of the equipage and supplies in the custody of the engineer officer, the relieving officer must inspect outstanding requisitions of the engineering department and inspect the inventory, stowage, and preservation of engineering storerooms and toolrooms. After conducting an inventory of accountable equipment in custody of the engineer officer, the relieving officer signs the necessary custody cards. The officer being relieved must prepare surveys on all missing accountable equipage.

Circumstances may prevent the engineer officer and his relief from making a joint inspection and report. When this occurs, the relieving officer or incoming head of the engineering department, must make the inspection as soon as possible and submit his report to the commanding officer within twenty days after taking charge of the engineering department.

Upon effecting relief, the incumbent engineer officer reports the fact and the conditions existing in the engineering department to the commanding officer by letter, via the relieving officer who endorses it after ascertaining there are no omissions or exceptions in the basic letter. The relieving officer should not hesitate to ensure that the condition of the department as stated in the relieving letter reflects the actual conditions that exist. Hesitancy at this time may lead to future embarrassment when the commanding officer requires an explanation for the occurrence of an engineering casualty.

CHAPTER 2

THE ENGINEERING DEPARTMENT

It is the job of every officer in the engineering department to ensure the operational readiness of the department and thereby, the operational readiness of the ship. Morale and training of personnel, and maintenance of material are three factors essential for optimum readiness. Proper administration of the department promotes and sustains these factors. Effective administration demands planning, organizing, commanding, and controlling. Of all the elements of administration, organization (the machinery of administration) is the most important. The effectiveness of the organization of the engineering department is dependent upon adherence to the following principles: unity of command, homogeneity of assignment, span of control, and delegation of authority.

Unity of command is the requirement that a person report directly to and receive orders from one superior. One person must have control over one segment of the organization, and he alone must issue all orders to and receive all reports from that segment. All personnel in the engineering department must know whom they direct and to whom they report. To accomplish unity of command within the department, the chain of command has to be definite, clear-cut, and understood and obeyed by all. Confusion and conflict are certain to result when the chain of command is ignored, either from the top down or from the bottom up. The engineer officer must make every effort to indoctrinate his division officers so that they are made aware of the importance of maintaining the chain of command.

Homogeneity of assignment is the requirement that each division in the department be assigned closely related tasks, that each unit under a division be assigned specific functions to perform, that individuals be assigned to divisions in accordance with their abilities, and that individuals not be assigned to direct unrelated groups unless it is unavoidable.

Span of control is the requirement that the type of work to be done and the degree of complexity and responsibility involved determine (1) the number of personnel supervised by one person, (2) the area involved in the supervision, (3) the time available, and (4) the way in which the supervisor is to use the time.

Delegation of authority is the requirement that authority commensurate with assigned responsibility be delegated to the lowest level of competence within the department. Delegation of authority does not mean that the officer relinquishes his responsibility for the actions of the person to whom such authority is delegated. Ultimate accountability for the performance of their individual organizational segments remains with the officers at all levels even though they may have charged subordinates with the immediate responsibility and delegated authority for managing certain functions.

The type commander (or higher authority) establishes the requirements for organization in the form of organization charts and functional guides that encourage the use of the best techniques known for the operation of the engineering department and the administration of assigned personnel. The process of organization has two aspects—the mechanical, which deals with organization structure; and the dynamic which deals with the integration of the human factors into the organization structure. While the mechanics of the organization of the engineering department are primarily the responsibility of higher authority, effective administration (dynamics) of the organization is the responsibility of the engineer officer.

In addition to the aforementioned elements of administration and organization, the personnel and the various organizations which the engineer officer will be required to administer are discussed in detail in this chapter. The chapter also includes information concerning certain aids (directives and ship's bills) that, when properly used, can facilitate the engineer officer's tasks involving command and control.

ENGINEERING PERSONNEL

The missions and tasks of the ship as established by the Chief of Naval Operations provide the basis for the equipment installed in the ship. The number of personnel assigned is ultimately fixed by the manning requirements of the equipment in the ship as determined by the Chief of Naval Operations.

The Chief of Naval Operations has assumed from the Chief of Naval Personnel (since July 1965) the responsibility for promulgating manpower authorizations. The ship's COMPLEMENT (for fleet units or shore activities) comprises the personnel required for operating and fighting the ship under wartime conditions and the ship's ALLOWANCE (for fleet units or shore activities) comprises the personnel required for peacetime operations. The number of personnel actually assigned to the ship is determined by manning levels (usually expressed as a percentage of complement in wartime or allowance in peacetime) based on the number of personnel available to the Chief of Naval Operations.

Additional information concerning manpower authorizations and procedures for requesting changes can be obtained by referring to OPNAV INSTRUCTION 1000.16, dated 21 July 1965.

DIVISION OFFICERS

The engineering department of a naval ship is organized into divisions and each division is headed by a division officer as appointed by the commanding officer. Each division officer is responsible for the organization, administration and operation of his division(s). The basic administrative organization of a shipboard division is shown in figure 2-1. The number of sections in each unit will depend upon the number of watch sections in the individual ship.

The division officer is responsible for ensuring that his assistants (technical and material assistant, division training officer, and junior division officer) properly perform their assigned duties. He is required to perform those duties, himself, when no assistants are assigned. The engineering division officers are responsible, under the engineer officer, for the operation, care, and maintenance of assigned machinery, equipment, and systems. They must keep the engineer officer informed of the operational readiness of assigned machinery, equipment, and systems.

Other duties, responsibilities, and authority of each division officer of the engineering department include:

1. Directing the operation of his division through leading petty officers in accordance with the division organization.
2. Assigning division personnel to watches, battle stations, and general duties; and instituting a system of rotating personnel between stations and duties in order to develop their skills and proficiency.
3. Scheduling and conducting training for personnel in the division. Division training should provide for the indoctrination of newly assigned personnel, assisting personnel to prepare for advancement in rating (including correspondence courses and practical factors in both military and professional subjects), individual instruction in shipboard duties, team training as necessary to fulfill operating requirements of the division, instruction in the principles of effective leadership, and individual training through courses of the United States Armed Forces Institute (USAFI). In accomplishing this function, the division officer receives guidance from the educational services officer.
4. Evaluating the performance of enlisted personnel of the division. The division officer initiates recommended grades for the senior petty officers in the division and reviews the senior petty officers' evaluations of the men under their supervision.
5. Maintaining a division notebook containing personnel data cards, training program data, a space and equipment responsibility log, watch and battle stations requiring manning by division personnel, and other useful data for ready reference and for orientation of the division officer's relief. Standard record forms (NavPers 2840 and the Division Officer's Personnel Record Form), which may be filed in a three-ring binder, are available through the general supply system.
6. Ensuring proper preparation, maintenance and submission of all forms, records, logs, reports, and correspondence required of the division.
7. Establishing and maintaining a division

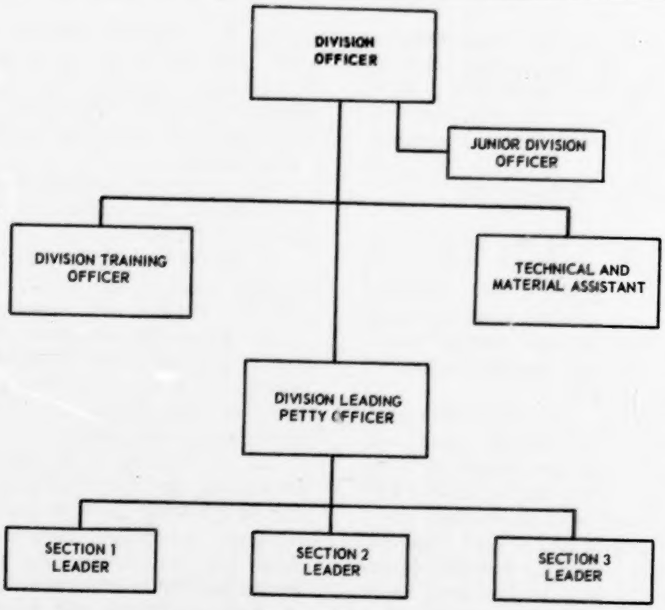

DIVISION OFFICER
JUNIOR DIVISION OFFICER
DIVISION TRAINING OFFICER
TECHNICAL AND MATERIAL ASSISTANT
DIVISION LEADING PETTY OFFICER
SECTION 1 LEADER
SECTION 2 LEADER
SECTION 3 LEADER

Figure 2-1.—Basic shipboard division organization.

114.3

organization manual and other directives necessary for the administration of the division.

8. Ensuring that all prescribed security measures and safety precautions are strictly observed by division personnel.

9. Recommending personnel for advancement in rating and for transfers.

10. Recommending changes in division personnel allowances.

11. Forwarding requests for leave, liberty, and special privileges, with recommendations.

12. Conducting periodic inspections, exercises, and musters to evaluate performance and discipline of the division. When disciplinary action is necessary, the division officer initiates the necessary action in accordance with the Uniform Code of Military Justice and other regulatory directives. (NOTE: The division officer and/or the department head attends Captain's disciplinary mast whenever one of their men appears before the CO for such action. This is to be available to represent the man and respond to any questions the CO may have concerning the man's professional ability.) Only the commanding officer may impose disciplinary punishments for minor offenses without the intervention of a court martial. This authority of a commanding officer cannot be delegated.

13. Cooperating with division officers of other divisions in the department, and recommending improvements in departmental policies and procedures to the engineer officer.

On a typical ship, the division officer in the engineering department reports to either the main propulsion assistant, the damage control assistant, the electrical officer, or to the engineer officer in the performance of his assigned duties. (NOTE: The duties of the main propulsion assistant and the damage control assistant are covered in chapter 1.) The junior division officer, the technical and material assistant (when so assigned in the departmental plan of organization), and the leading petty officer report to the division officer in the performance of their assigned duties and for daily operations in the division.

The job of division officer (or junior division officer in some large naval ships) is usually the first job assigned a young officer upon reporting aboard ship. The tasks confronting the new division officer may appear monumental to him at first, but he should realize that he has been given a position in an organization which is designed to function efficiently for long periods of time without all its members and one which can easily absorb a few untrained members from time to time. People on all sides are available with assistance to help if he expresses a desire to learn. The officer he relieves can be of invaluable assistance and will usually utilize all available time to instruct him in his duties; outline the current program, pointing out what has and has not been done; discuss the inherent difficulties of the job; and advise him concerning the abilities and personalities of his men. The senior officers always stand ready to give him a hand. The engineer officer, while tolerant of his inexperience, will insist that he do his duty and master his job as quickly as possible. The job of division officer affords the young naval officer his best opportunity to develop and demonstrate his leadership and administrative abilities.

Relatively few division officers are afforded the luxury of a junior division officer, a division training officer, and a technical and material assistant. In some ships where the number of available officers is limited (especially in the engineering department) one officer may be in charge of several divisions. The promising young naval officer views such a challenge merely as an opportunity to broaden his experience and welcomes the assignment of division officer in the engineering department.

JUNIOR DIVISION OFFICER

Principally, the junior division officer, when assigned, assists the division officer in coordinating and administering the division and by experience, develops a thorough understanding of the functions, directives, and equipment of the division in preparation for assuming the duties of the division officer.

Contingent on the division organization and the capacity shown by the junior division officer, the division officer may direct him to:

1. Supervise the preparation and maintenance of the watch, quarter, and station bills, and such other bills as may be necessary for the operation of the division.
2. Assist in the formulation and implementation of policies and procedures for the operation of the division.
3. Supervise the division in the performance of the daily routine and conduct frequent inspections to assure that division functions are being properly executed.
4. Aid in the administration of discipline within the division.
5. Evaluate individual performances of division personnel (assisted by leading petty officers of the division) and recommend periodic grades to the division officer.
6. Provide counsel and guidance to personnel of the division.
7. Ensure the proper preparation, maintenance, and submission of logs, records, and reports required of the division.
8. Act as division officer in the absence of the division officer.
9. Perform such other duties as may be assigned by the division officer or other competent authority.

While the junior division officer can profit considerably from careful observation of the methods of those officers more skilled than he, eventually some decisions of his own must be attempted. If the junior division officer is incapable of making decisions, he will be valueless as a leader. When approached with a problem, he is expected to supply a definite solution. When he lacks the authority to decide, he must refer the matter to the officer who is in a position to act on it and relay the decision. If he does not know the answer, he need not fear that he will appear stupid. It is not expected that he will learn all the details of his job overnight, but he will be expected to take immediate action toward finding the answer. Never try bluffing for it is certain to make the one who attempts it look ridiculous. The inexperienced officer must never allow the dread of making a mistake to deter him from the attempt to solve a problem. He will make occasional mistakes, to be sure, but an honest mistake seldom invokes scorn or censure, particularly if all the factors involved were duly considered.

No officer can be an effective disciplinarian if those whom he commands cannot observe discipline in him. The young man who aspires to the career of a naval officer can do no less than live so that his daily conduct, in all respects, will be above reproach.

DIVISION TRAINING OFFICER

The division training officer, when assigned, aids and advises the division officer in the administration of training within the division and coordinates the division training program with the departmental and overall training program of the ship. The duties of the division training officer are discussed in considerable detail in chapter 4 of this publication.

TECHNICAL AND MATERIAL ASSISTANT

The technical and material assistant, when assigned, is usually a warrant officer or a limited duty officer. Primarily, his job is to supervise the maintenance and repair of the material, equipment, and systems for which the division is responsible.

The technical and material assistant is responsible under the division officer for:

1. The proper performance of preventive and corrective maintenance procedures on all equipment material, and systems assigned to the division.
2. The review for technical accuracy of all completed Maintenance Data Control System (MDCS) documents reporting the completion of maintenance.
3. The proper preparation, maintenance, and timely submission of material, equipment, and system records, reports, and logs required of the division.
4. The preparation and timely submission of requests for repair parts and other materials necessary for the efficient operation of the equipment, material, and systems assigned the division.
5. The repairs to equipment and material of other divisions which are beyond the capacity of those divisions but within the capacity of his division.
6. The performance of such other duties as may be assigned.

ENLISTED PERSONNEL

A thorough understanding of the enlisted rating structure is essential to effective administration of the engineering department. The rating structure is a single integrated structure applicable to personnel of both the U. S. Navy and the Naval Reserve, and is intended to serve peacetime and wartime needs and eliminate the requirement for elaborate expansion and conversion upon mobilization. The structure consists of general ratings, service ratings, emergency ratings, and general rates. Ratings are established or disestablished by the Chief of Naval Personnel upon approval of the Secretary of the Navy as dictated by the needs of the service.

General ratings are broad occupational fields, encompassing essentially similar duties and functions, which require related patterns of aptitudes and qualifications, and which provide paths of advancement for career development. General ratings apply to personnel of the U. S. Navy and Naval Reserve, provide the primary means of identifying billet requirements and personnel qualifications, and have distinctive rating badges. There are two types of general ratings, those with no subspecialties or service ratings, and those with service ratings.

Service ratings are subdivisions of certain general ratings, which, by delineating specific areas of qualifications, provide for specialization in training and utilization of personnel in complex work areas. Service ratings apply to personnel of the U. S. Navy and Naval Reserve, and the rating badge is the same as that of the associated general rating. Shipfitter (SF) is a general rating which contains the service ratings of shipfitter (metalsmith) and shipfitter (pipefitter) at the petty officer 3 and 2 levels within its scope. While the service rating was initially developed to satisfy the requirement for increased specialization at the lower petty officer levels, it is sometimes needed at higher levels and may be established at any paygrade as dictated by the needs of the service. However, the concept of broad knowledge at the higher levels in the ratings is retained and specialization at the higher paygrades is the exception rather than the rule.

Emergency ratings comprise occupational fields for which there are no peacetime requirements in the Navy, but for which there is a definite need during wartime. Each emergency rating has its own distinctive rating badge. Stevedore (ESB) is an example of an emergency rating.

General rates are the general apprenticeships below the level of petty officer, such as fireman recruit, fireman apprentice, and fireman. The term rate is also used to identify personnel occupationally by paygrade.

The enlisted complement and allowance of the engineering department generally consists of enlisted personnel of the seaman and fireman rates, and the yeoman, engineering, and hull ratings. Enlisted men in the engineering department are assigned to divisions by the engineer officer in accordance with the ship's Personnel Assignment Bill. The division officer assigns enlisted men of the division to battle stations and condition watches in accordance with the ship's Battle Bill, to sections and special duties in accordance with the ship's Personnel Assignment Bill, and to regular duties and watches in accordance with various ship's bills.

Division officers are required to temporarily assign certain enlisted personnel of the engineering department to special duties in other departments in the ship in accordance with the ship's Personnel Assignment Bill. The temporary assignment may include duty in the ship's master-at-arms force (usually for a period of 6 months) and duty in the supply department as mess deck master-at-arms (usually for a period of 6 months) or as messmen (a period of 3 months). Normally, no man is assigned to two consecutive three-month tours of duty as messman and no man may involuntarily be assigned to a second three-month tour as messman without the approval of the executive officer.

Transfers of enlisted men between departments are subject to the approval of the executive officer. All transfers of enlisted men between divisions of the engineering department are subject to approval of the engineer officer. In all instances, transfers of enlisted men must be reported to the personnel officer for purposes of record.

Firemen

Personnel of the fireman rate train for one of the engineering and hull general or service ratings. A fireman apprentice (FA) or fireman (FN) may be identified as strikers for ratings for which they have successfully completed naval school training, or for which they have demonstrated significant qualifications in the servicewide examinations for advancement but whose scores and/or multiples were not sufficiently high to warrant advancement and if no excess of petty officers exists in the particular ratings. Control of the assignment of striker is normally exercised by the Chief of Naval Personnel by regulating school quotas and by administering the designation of in-service trained personnel through the Naval Examining Center. The striker identification is added to the abbreviation of the individual's rate. For example, a fireman striker for the rating of electrician's mate (EM) is identified by the rate symbol EMFN.

The striker identification may be removed by an individual's commanding officer for reasons of incompetency provided such action is substantiated by an entry (in the individual's service record) of an unsatisfactory evaluation in professional performance. Otherwise, requests for removal of the striker identification must be submitted to the Chief of Naval Personnel. Restrictions on the removal of striker identifications are necessary to prevent diversion of qualified strikers to other duties because of local shortages or excesses in certain ratings and to ensure that qualified personnel are utilized in duties for which they have received special training.

A fireman recruit (FR) normally advances to FA upon successful completion of his recruit training. After 6 months as an FA, an individual is eligible for advancement to FN. Examinations for advancement to FN are administered locally, and may be prepared locally. However, it is recommended that they be taken from standard examination questions prepared and distributed to all commands by the Naval Examining Center. The qualifications for advancement to FN and all ratings are listed in the Manual of Qualifications for Advancement in Rating, NavPers 18068-B, including the latest changes.

Firemen stand messenger, cold iron, and fire watches. They are required to clean assigned spaces and equipment; make minor repairs to electrical and engineering equipment and material, and the ships' hull (depending upon the rating for which they train); record readings of gages; participate in general drills; and perform general detail duties. Normally, each division in the engineering department is assigned sufficient fireman for training to provide replacements for anticipated losses of petty officers.

Petty Officers

The complement and allowance of petty officers for the engineering department consists of personnel of the yeoman rating and the hull and engineering rating group. The ratings of the engineering and hull group are those of boilermaker (BR), boilerman(BT), damage controlman (DC), electrician's mate (EM), engineman (EN), interior communications electrician (IC), machinery repairman (MR), machinist's mate (MM), and shipfitter (SF). Yeoman strikers (YNSN) are sometimes assigned to the engineering department in lieu of yeomen.

BOILERMAKER.—is a general rating with no service ratings; however, the rating is presently limited to petty officers above the level of second class. Boilerman in the BT2 rate, if otherwise qualified, may compete for advancement to BR1. Boilermen in the rate of BT1 and above may submit requests to the Chief of Naval Personnel for change to the BR rating. Personnel of the boilermaker rating test, maintain, and repair marine boilers, heat exchangers, and associated equipment; inspect boilers and fireroom casualties, and effect corrective measures; perform all types of welding and allied processes pertaining to boiler repairs; and maintain records and reports.

BOILERMAN.—is a general rating with no service ratings. Firemen (FN), if qualified, may compete for advancement to BT3. Personnel of the boilerman rating operate marine boilers and fireroom machinery; transfer, test, and inventory fuels and water; perform preventive and corrective maintenance of boilers, pumps, and associated equipment, and prepare and maintain records, reports, and logs.

DAMAGE CONTROLMAN.—is a general rating with no service ratings. Fireman (FN), if qualified, may compete for advancement to DC3. Personnel of the damage controlman rating operate damage control, carpenter shop, firefighting, and NBC warfare defense equipment; instruct other personnel in the techniques and skills involved in practical damage control, firefighting, and NBC warfare defense, including the use of personnel decontamination stations and protective shelters; maintain damage control equipment in repair lockers; repair small boat hulls and composition and wooden deck coverings; perform the skills of carpentry; and prepare and maintain damage control logs, records, and reports.

ELECTRICIAN'S MATE.—is a general rating with no service ratings. Fireman (FN), if qualified, may compete for advancement to EM3. Electrician's mates operate electrical light and power generating, distribution, and control equipment; perform preventive and corrective maintenance of electrical generators, switchboards, motors, lighting fixtures, and other electrical equipment including small boat electrical systems; prepare and maintain electrical logs, records, and reports.

ENGINEMAN.—is a general rating with no service ratings, Fireman (FN), if qualified, may compete for advancement to EN3. Personnel of the engineman rating operate internal combustion engines and diesel propulsion plants, diesel generators, distilling plants, refrigeration and air conditioning systems, small boat propulsion equipment, hydraulic systems, and other auxiliaries such as cranes and winches; perform preventive and corrective maintenance of assigned machinery, material, and systems; prepare and maintain required logs, records, and reports.

INTERIOR COMMUNICATIONS ELECTRICIAN.—is a general rating with no service ratings. Fireman (FN), if qualified, may compete for advancement to IC3. Interior communications electricians operate gyro compass systems, interior communication systems, and motion picture equipment; perform preventive and corrective maintenance of gyro compass systems, interior communications systems, sound powered telephone systems, automatic telephone systems, and sound motion picture systems and related equipment; and prepare and maintain required logs, records, and reports.

MACHINERY REPAIRMAN.—is a general rating with no service ratings. Fireman (FN), if qualified, may compete for advancement to MR3. Personnel of the machinery repairman rating effect repairs to shipboard machinery using machine shop equipment such as lathes, milling machines, boring mills, grinders, power hacksaws, drill presses, and other machine tools; perform preventive and corrective maintenance of shop machinery; and prepare and maintain shop files, records, and reports.

MACHINIST'S MATE.—is a general rating with no service ratings. Fireman (FN), if qualified, may compete for advancement to MM3. Machinist's Mates operate steam-propulsion machinery and associated auxiliaries, turbogenerator plants, distilling plants, refrigeration and air conditioning systems, and other auxiliary machinery such as steering engines, anchor windlasses, and cranes and winches; perform preventive and corrective maintenance of assigned machinery material, and systems; prepare and maintain required logs, records, and reports.

SHIPFITTER.—is a general rating with the two service ratings of shipfitter M (metalsmith) and shipfitter P (pipefitter) at the third and second class petty officer levels. Fireman (FN), if otherwise qualified, may compete for advancement to SFM3 or SFP3. Personnel of the shipfitter (M) rating operate furnaces, forges, and shop equipment associated with metalwork;

layout, fabricate, install, and repair metal structures; lay out, bend, shear, rivet, weld, braze, tin, and solder sheet metal; operate and maintain assigned damage control equipment; prepare and maintain required logs, records, and reports. Personnel of the shipfitter (P) rating perform high-pressure and low-pressure pipe fitting; layout, assemble, install, maintain, and repair plumbing and other sanitary equipment and fixtures; install lagging and other pipe coverings; operate and maintain assigned damage control equipment; prepare and maintain required logs, records, and reports. Petty officers of the rates of SFM2 and SFP2, if qualified, are eligible to compete for SF1. Personnel of the shipfitter (first class and chief petty officers) rating plan, supervise, and perform other tasks necessary for the fabrication, installation, and repair of metal structures and the installation and maintenance of plumbing and high-pressure and low-pressure piping systems; organize, supervise, and instruct assigned personnel in preventive and corrective maintenance procedures; prepare and maintain required records and reports.

YEOMAN.—is a general rating with no service ratings. Seamen (SN), if qualified, may compete for advancement to YN3. Yeomen perform clerical and secretarial duties such as typing and filing; operate duplicating equipment; prepare and route correspondence and reports and maintain records and publications. Yeomen assigned to the engineering department assist in the administration of the log room and are responsible for its cleanliness and maintenance.

ENGINEERING DIVISIONS

The auxiliaries (A), boilers (B), electrical (E), main engines (M), and repair (R) divisions are the divisions of the engineering department. All of the divisions are not in the engineering department of all ships. The engineering department, for example, of a ship with no main boilers has no boiler division. Figure 2-1 illustrates the basic administrative organization of a division. The organization illustrated may be modified to meet the needs of a particular division.

The Watch, Quarter, and Station Bill is the division officer's summary of assignments of personnel to duties and stations specified within each of the ship's bills. Its primary purpose is to inform division personnel of those assignments.

The number of divisions, which are assigned to the engineering department through the assignment of personnel to billets within the ship, is based upon the ship's complement and allowance and is intended to provide an effective organization.

Personnel in the engineering department are assigned locker and berthing facilities in accordance with the ship's Berthing and Locker Bill. Divisions are assigned responsibilities for the maintenance, preservation, and cleanliness of the exterior and interior of the ship's hull, hull fittings, machinery, and equipment in accordance with the ship's Cleaning and Maintenance Bill. The Berthing and Locker Bill and the Cleaning and Maintenance Bill are administrative bills of the ship's organization and regulations manual.

Auxiliaries Division

The auxiliaries division officer heads the auxiliaries division. Personnel of the engineman, machinist's mate, and machinery repairman ratings are assigned to the division.

The auxiliaries division is assigned responsibility for the cleanliness and maintenance of such spaces as the air conditioning machinery room, air compressor room, anchor windlass room, emergency generator room, evaporator room, fire pump room, fan rooms, internal combustion engine shop, refrigerating machinery room, steering gear room, machine shop, auxiliary machinery room, aircraft elevator machinery room, and boat winch machinery room. The auxiliaries division is generally assigned the responsibility for the preventive and corrective maintenance of winches and cranes, emergency generators, air conditioning and refrigeration equipment and systems, laundry and dry cleaning machinery, galley machinery, steering engines, anchor windlasses, air compressors and compressed air systems, emergency fire pumps, boat engines and boat propulsion machinery, internal combustion engines not specifically assigned to another department, distilling plant machinery and equipment, auxiliary boilers, hydraulic systems, elevator machinery, ventilating equipment, and heating system.

Boilers Division

The boilers division officer heads the boilers division. Personnel of the boilerman and boilermaker ratings are assigned to the division.

23

The boilers division is assigned responsibility for the cleanliness and maintenance of such spaces as the firerooms, forced draft blower room, fuel oil storage tanks, fireroom uptake spaces, and test laboratory. The boilers division is generally assigned the preventive and corrective maintenance of the boilers, fireroom auxiliaries, forced draft blowers, fuel and water testing apparatus, the equipment for fueling at sea, and fuel oil piping and pipe fittings.

Electrical Division

The electrical division officer heads the electrical division. Personnel of the electrician's mate and interior communications electrician ratings are assigned to the division.

The electrical division is assigned responsibility for the cleanliness and maintenance of such spaces as the electrical shop, gyro room, I.C. room, I.C. shop, storage battery room, battery locker, underwater log compartment, winch controller rooms, wiring trunks, and switchboard rooms. The electrical division is generally assigned the preventive and corrective maintenance of all electrical motors, generators, and controllers not specifically assigned to another department, degaussing systems, electrical distribution systems including cabling and switching and protective equipment, gyro compasses and related equipment such as the dead reckoning analyzer and dead reckoning tracer, battery charging equipment, underwater log system, small boat electrical systems, automatic and sound powered telephone systems, sound motion picture equipment, lighting systems, interior communication systems including ship control and indicating systems, portable announcing systems, magnesyn compass system, and portable electric tools.

Main Engines Division

The main engines division officer heads the main engines division. Personnel of the machinist's mate (steam) and engineman (diesel) ratings are assigned to the division in accordance with the type of main propulsion machinery installed. Yeomen of the engineering department are assigned to the main engines division.

The main engines division is assigned responsibility for the cleanliness and maintenance of such spaces as the enginerooms, engineering department office, engineroom uptake spaces, fresh and feed water tanks, engineer storeroom, and shaft alleys. The main engines division is generally assigned the preventive and corrective maintenance of the main engines and propulsion equipment including shafting, engineroom auxiliaries, ship's service generator drive units, and engineroom piping systems.

Repair Division

The repair division officer heads the repair division. Personnel of the damage controlman and shipfitter ratings are assigned to the division.

The repair division is assigned responsibility for the cleanliness and maintenance of such spaces as the carpenter shop, structural shop, pipe shop, gas masks and protective clothing lockers, repair party lockers, and the central control station (damage control central). The repair division is generally assigned the preventive and corrective maintenance of damage control equipment, and firefighting equipment, hull fittings, and piping systems, not otherwise assigned. The repair division provides welding and allied services to other divisions as required.

WATCH ORGANIZATION

All personnel (enlisted and officer) in the ship's watch organizations, as in any effective organization, must understand their functions, responsibilities, authority, and organizational relationships. Doubt and misunderstanding attributable to misinterpretation or a lack of knowledge of the ship's watch organization can lead to confusion and conflict resulting in collision, grounding, or total loss of the ship while underway; and equipment and machinery derangement, fire, serious personnel injuries, or even loss of life in the ship while moored or at anchor. There must be complete cooperation between all parts of the organization as well as between the members of the separate parts.

Security of the ship under all probable conditions is the primary objective of the ship's watch organizations and optimum efficiency in administration is a secondary objective. Requirements for specified degrees of readiness and for condition watches are established by the type commander.

Normally, the security of the ship is adjusted to the demands of the current situation by the employment of one of six general degrees of readiness which are based upon the probability of attack and/or battle as related to the combat ability of the forces required to meet the threat. Condition watches are the ship's watch organizations which satisfactorily meet the various general degrees of readiness.

The first general degree of readiness requires complete readiness of the ship for immediate action. Condition watch I is the watch organization which provides for manning of the necessary watch stations (battle stations) for the first degree of readiness.

The second general degree of readiness allows temporary relaxation from the first degree of readiness to enable personnel to rest and to permit designated personnel to draw and distribute meals at battle stations. Condition watch IE is the watch organization which provides for the manning of watch stations for the second degree of readiness.

A special general degree of readiness that is applicable to certain ships provides for maintaining armament ready for immediate action for prolonged periods of time such as extended periods of shore bombardment. Condition watch II is the watch organization which provides for the manning of watch stations for the special degree of readiness.

The third general degree of readiness requires a part of the armament ready for immediate action and the remainder on short notice. The fourth general degree of readiness requires a part of the armament ready for immediate action and the remainder at prolonged notice. Condition watch III is the watch organization which provides for the manning of watch stations for either the third or fourth general degrees of readiness.

The fifth general degree of readiness is generally referred to as peacetime cruising and requires no manning of armament. Condition watch IV is the watch organization which provides for the manning of watch stations for the fifth degree of readiness.

The sixth general degree of readiness applies to the ship in port under peacetime conditions and requires no manning of armanent. Condition watch V is the watch organization which provides for the manning of watch stations for the sixth degree of readiness.

The administration of condition watches III, IV, and V requires the particular attention of the engineer officer and his division officers. The watch stations of the other condition watches are prescribed, by billets, in the ship's Battle Bill. The engineering department requirements are the same for condition watch III (wartime cruising) and condition watch IV (peacetime cruising) in most ships, therefore, only condition watch IV and condition watch V (peacetime in-port) are discussed in detail in this publication.

To ensure a smooth transition from one of the three watch conditions (III, IV, and V) to another, each watch is divided into three sections with each section being trained to fulfill all the duties for wartime cruising, peacetime cruising, and peacetime conditions in port. With a properly trained crew the ship may, as a matter of routine, enter port or put to sea without special adjustments in watches and without requiring abnormally long watches for key personnel.

The three sections become watches 1, 2, and 3 during condition watch III. Such watches normally rotate duties underway in successive four hour periods. Where practicable, personnel should be assigned the same watch station for condition watch III that they will man for condition watch I.

In port or at anchor where condition watch V is permitted, the watches and duties are assumed by each section in succession for a period of 24 hours and each section, where practicable, may be divided into three watch units.

The three section watch is easily modified to conform with special or local conditions. For example, if 50 percent of the ship's crew is required to remain on board at all times in a certain port, one of the sections can be split and personnel of that section can be evenly assigned, by rates and numbers, to the remaining two sections. When modifications are necessary division officers should maintain as much of the original three sections as possible.

UNDERWAY WATCHES

The watch organization for condition watch IV must provide adequate qualified personnel for the safe and efficient normal underway operation of the ship in peacetime, while permitting the best economy of personnel in assignment to watches. In condition watch IV:

1. No weapon batteries are manned.
2. The engineering plant is ready for power and speeds as ordered.
3. Material condition Yoke is set and may be modified for access during daylight hours.
4. Complete surface and horizon lookout

coverage is provided. Air lookouts are stationed when flight operations are in progress in the vicinity.

5. CIC is sufficiently manned for routine purposes. Interior communications are manned as necessary. Exterior communications are manned as required to cover the communication plan in effect.

6. Aircraft are in the condition of readiness required by the flight schedule.

The condition watch IV watch organization of a typical ship is shown in figure 2-2. The executive officer may relieve the officer of the deck in times of danger or emergency as prescribed in U.S. Navy Regulations. The navigator may relieve the officer of the deck when authorized or directed by the commanding officer. The lookouts and CIC watches report simultaneously to the CIC watch officer and the officer of the deck. The steering aft watch is under operational control of the officer of the deck but under the technical control of the engineering officer of the watch.

Watch officers are in charge of the watch to which they are assigned. The watch officer supervises and controls the performance of those on watch under him and is stationed where he can best perform his assigned duties.

Officer of the Deck (Underway)

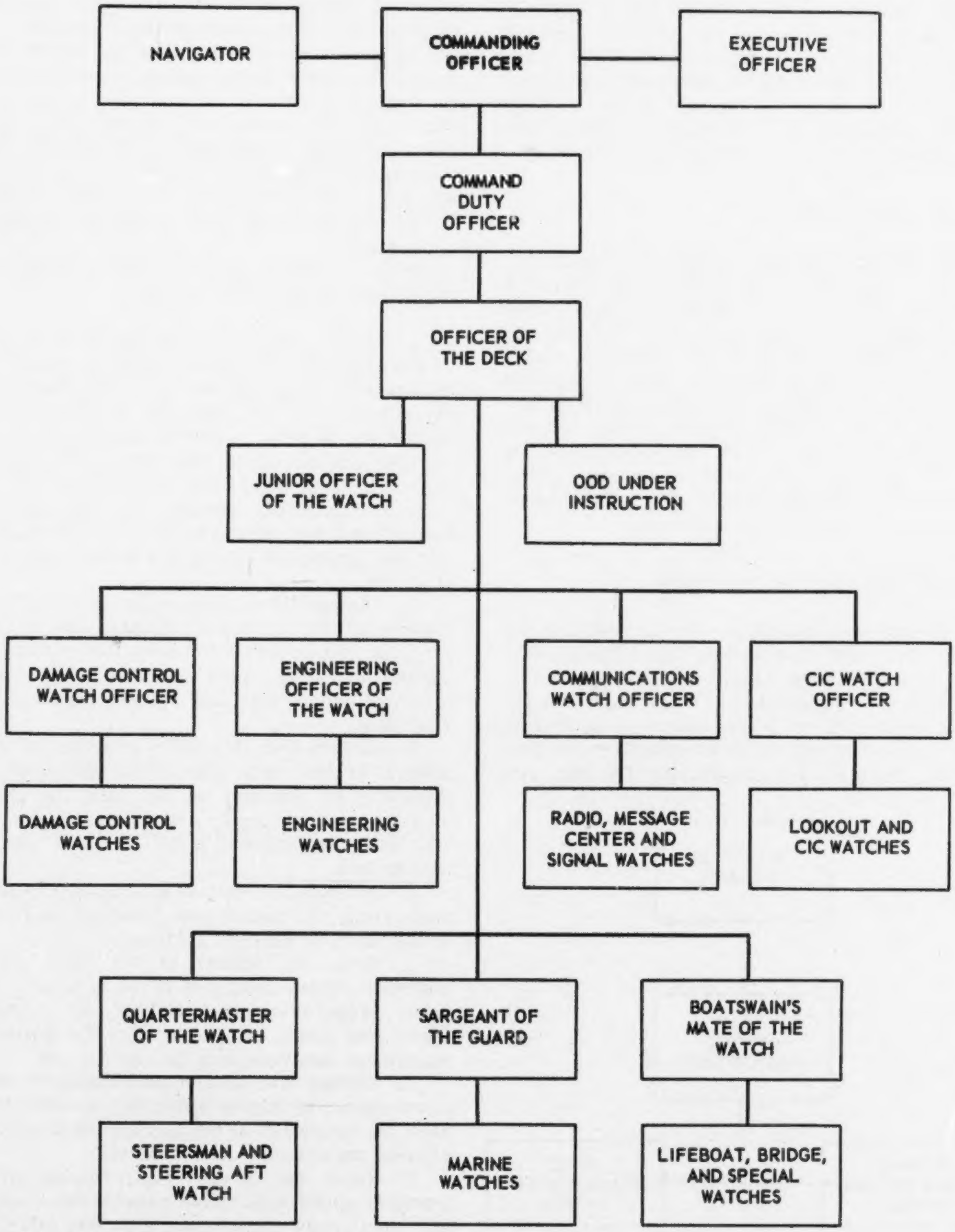
The officer of the deck (OOD) underway (and in port) is the watch officer designated by the commanding officer to be in charge of the ship. The officer of the deck is primarily responsible, under the commanding officer, for the safe operation of the ship. The duties, responsibility, and authority of the officer of the deck are prescribed in U.S. Navy Regulations; and are discussed in considerable detail in Naval Orientation, NavPers 16138 (revised).

The officer of the deck reports directly to the commanding officer for the safe navigation and general operation of the ship; to the executive officer (and command duty officer, if appointed by the commanding officer) for carrying out the ship's routine; and to the navigator for sightings of navigation landmarks, and for course/speed changes. The OOD may request advice and assistance in the discharge of his duties from any person assigned to the ship for duty.

Damage Control Watch Officer

The damage control watch officer supervises the maintenance of the material condition of readiness in effect in the ship and is responsible for the operation of the various hull systems. In the performance of his duties he must:

1. Maintain a rough log which includes hourly entries of the firemain pressure and the number of fire pumps in operation, and such other entries as getting underway, anchoring and mooring, general quarters, emergency drills, and setting of material conditions (with a list of discrepancies reported and the corrective action taken).
2. Supervise the maintenance of the damage control log which contains violations of the material condition of readiness prescribed. Log entries must include the name and rate of the person requesting the authority to violate a prescribed condition, the time of violation, type of fittings involved, the estimated duration of the violation, and the actual time the material condition of readiness is restored.
3. Determine the status of fuel and ballast tanks that were emptied or filled during the watch and enter the information, including the number of the tanks concerned, in the rough log.
4. Render hourly reports to the officer of the deck concerning the watertight integrity of the ship.
5. Ensure that damage control patrols sound all voids and cofferdams once each watch (once each day, in port) and report results.
6. Ensure that the ship's draft is recorded (taken, if in port, otherwise it is computed) daily during the 04-08 watch, prior to entering or leaving port, and before and after replenishment (fueling, provisioning, or rearming).
7. Notify the officer of the deck, damage control assistant, and weapons (deck) department officer when the fire alarm board indicates that temperature of any magazine is above 105 F.
8. Maintain custody of the master key for repair party lockers and ensure that it is issued only to authorized personnel.
9. Ensure that material condition Yoke is set prior to sunset. Normally, at the end of the working day (approximately 1700) the damage control watch officer requests the officer of the deck to have all divisions check the setting of material condition Yoke and make reports to damage control central. The damage control watch officer initiates the necessary followup action to ensure compliance by divisions failing to make reports.


NAVIGATOR
COMMANDING OFFICER
EXECUTIVE OFFICER
COMMAND DUTY OFFICER
OFFICER OF THE DECK
JUNIOR OFFICER OF THE WATCH
OOD UNDER INSTRUCTION
DAMAGE CONTROL WATCH OFFICER
ENGINEERING OFFICER OF THE WATCH
COMMUNICATIONS WATCH OFFICER
CIC WATCH OFFICER
DAMAGE CONTROL WATCHES
ENGINEERING WATCHES
RADIO, MESSAGE CENTER AND SIGNAL WATCHES
LOOKOUT AND CIC WATCHES
QUARTERMASTER OF THE WATCH
SARGEANT OF THE GUARD
BOATSWAIN'S MATE OF THE WATCH
STEERSMAN AND STEERING AFT WATCH
MARINE WATCHES
LIFEBOAT, BRIDGE, AND SPECIAL WATCHES

114.4

Figure 2-2.—Condition Watch IV watch organization of a typical naval ship.

27

The damage control watch officer reports directly to the officer of the deck on matters affecting watertight integrity, stability, trim, or other conditions which adversely affect the safety of the ship. He reports to the damage control assistant for technical control and matters affecting the administration of his watch.

Damage Control Watch

The damage control condition IV watch organization is shown in figure 2-3. Enlisted personnel of the repair division normally man the damage control patrol watches. The damage control patrols report to the damage control watch officer. When condition watch II stations are manned, the petty officers in charge of the various repair lockers report to the damage control watch officer. Chief and first class petty officers of the repair division in some ships augment the watch personnel assigned the duties of the damage control watch officer.

Engineering Officer of the Watch

The engineering officer of the watch is the officer on watch in charge of the main propulsion plant and of the associated auxiliaries. He is primarily responsible for the safe and efficient performance of the engineering department watches (except damage control) associated with the equipment in his charge. The engineer officer determines if an officer of the engineering department is qualified to perform the duties of the engineering officer of the watch. When he considers the officer qualified in all respects, the engineer officer assigns him to the watch. The engineer officer or, in his absence, the main propulsion assistant is authorized to direct the engineering officer of the watch concerning the duties of the watch or to assume the duties of the watch when such action is considered necessary.

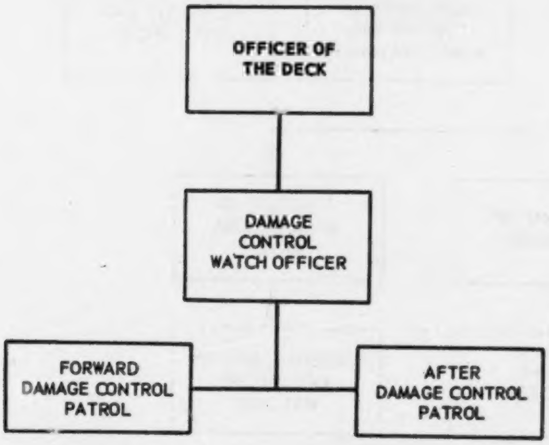

OFFICER OF THE DECK
DAMAGE CONTROL WATCH OFFICER
FORWARD DAMAGE CONTROL PATROL
AFTER DAMAGE CONTROL PATROL
114.5

Figure 2-3—A typical Condition Watch IV damage control watch organization.

In the performance of his duties the engineering officer of the watch must:

1. Cause frequent inspections to be made of the machinery (boilers, engines, generators, evaporators, and auxiliaries) of the engineering department for the purpose of ensuring that machinery is being operated in accordance with current instructions; that required logs are properly maintained; that machinery and controls are properly manned; that all applicable inspections and tests are being performed; and that all applicable safety precautions are being observed.
2. Frequently monitor interior communications circuits in use to ensure that required circuits are properly manned; that circuit discipline is being maintained; and that correct message procedures and terminology are being employed.
3. Ensure that all orders received from the officer of the deck concerning the speed and direction of rotation of the main propulsion shafting are promptly and properly executed, and that the engineer's bell book is properly maintained.
4. Immediately execute all emergency orders concerning the speed and direction of rotation of the main propulsion shafting.
5. Keep the officer of the deck and the engineer officer informed of the condition of the main propulsion plant and of the maximum speed and power available with the boiler and machinery combinations that are in use.
6. Ensure that all directives and procedures promulgated by higher authority, and which concern the operation of the machinery of the engineering department, are observed.
7. Know the power requirements for all possible operations and determine that the boiler and machinery combinations in use effectively meet current operational requirements. Advise the engineer officer and the officer of the deck when modification of the machinery combinations

in use is considered appropriate. Inform the officer of the deck of any necessary changes in the operation of boilers, main engines, generators, and other major auxiliaries.

8. Supervise the training of the personnel of the watch during the watch. Operational training should be accomplished primarily through investigation, demonstration, and drill while actually performing duties of the watch. The engineering officer of the watch should insist that each person in charge of an engineering watch station carefully instruct the personnel under his charge in his specific duties and in the duties of all persons on the same watch station.

9. Perform such other duties as the engineer officer may direct. The engineering officer of the watch reports to the officer of the deck for changes in speed and direction of rotation of the main propulsion shafting and for requirements of standby power and other engineering services anticipated or ordered. The engineering officer of the watch reports to the engineer officer for technical control and matters affecting the administration of the watch.

The watches of the officer, assigned a watch as the engineering officer of the watch under instruction, should be rotated in order to give him an opportunity to serve with all of the qualified officers rather than only one of them. Standing watch with the various officers affords the officer under instruction the opportunity to develop a more thorough understanding of the functions and characteristics of the machinery, equipment, and systems of the engineering plant, for each engineering officer of the watch will either be a division officer or one of the engineer officer's assistants and will have a special knowledge of, or interest in, a different part of the plant. On smaller ships with a limited number of engineering officers, senior petty officers may be assigned as officer of the watch.

Engineering Watches

The engineering condition watch IV watch organization for a typical ship is illustrated in figure 2-4. The structure of the watch organization is determined by the type, arrangement, and location of the machinery in the engineering plant and generally differs according to the type of ship. The engineering watch organization as well as the instructions for each watch station must be included in the engineering department organization and regulations manual. Instructions for the watch must be posted at each watch station.

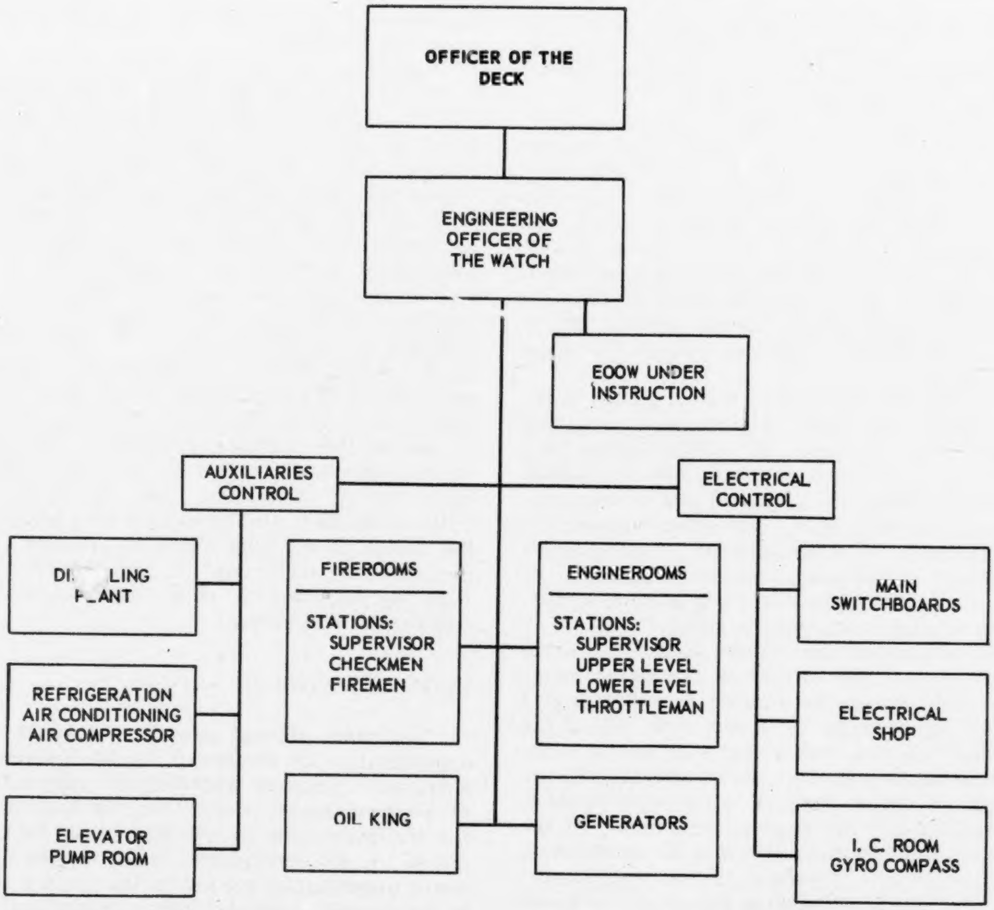
Personnel of the electrical division normally man an underway watch at each operating main distribution switchboard and in the interior communication room, gyro compass room, and electric shop. Personnel of the auxiliaries division normally man underway watches associated with the distilling plant, refrigeration and air conditioning systems, air compressors, and hydraulics systems in elevator pump rooms and the steering gear room (steering aft). The auxiliaries division also assigns a man as engineer of the lifeboat watch. Personnel of the main engines division normally man underway watches in the enginerooms and shaft alleys. The main engines division also assigns a man to operate the electrical generators. Personnel of the boilers division man the boiler watches (supervisor, checkman, and fireman). The boilers division also assigns a man to perform the duties of oil king. Division officers assign personnel to underway watches in accordance with the engineering department organization and regulations manual.

IN-PORT WATCHES

The basic normal peacetime in-port watch organization is discussed in this publication. Additional watches providing for the manning of weapons systems and security stations, and for the prevention of sabotage must be established in an emergency or in wartime. The watch organization for condition watch V, shown in figure 2-5, provides adequate qualified personnel for the safe and efficient normal peacetime operation of the ship in port.

Command Duty Officer

The engineer officer, if qualified, may be assigned the duties of command duty officer in port. The command duty officer in port, eligible for command at sea, is designated by the commanding officer as deputy to the executive officer for carrying out the routine of the ship in port and for supervising and directing the officer of the deck in matters concerning the safety and general duties of the ship. The duties of the executive officer are performed by the command duty officer in port when the executive officer is temporarily absent from the ship.


OFFICER OF THE DECK
ENGINEERING OFFICER OF THE WATCH
EOOW UNDER INSTRUCTION
AUXILIARIES CONTROL
ELECTRICAL CONTROL
DISTILLING PLANT
REFRIGERATION
AIR CONDITIONING
AIR COMPRESSOR
ELEVATOR
PUMP ROOM
FIREROOMS
STATIONS:
SUPERVISOR
CHECKMEN
FIREMEN
ENGINEROOMS
STATIONS:
SUPERVISOR
UPPER LEVEL
LOWER LEVEL
THROTTLEMAN
OIL KING
GENERATORS
MAIN SWITCHBOARDS
ELECTRICAL SHOP
I. C. ROOM
GYRO COMPASS

114.6

Figure 2-4—A typical Condition Watch IV engineering watch organization.

Engineering Department Duty Officer

In ships not underway, the commanding officer may authorize the standing of a day's duty in lieu of the continuous watch of the engineering officer of the watch. When authorized, the duties of the engineering officer of the watch are assigned in port to the engineering department duty officer, however, when not at the station of the engineering officer of the watch, the duty officer must always be ready to appear the moment he is summoned or notified that his presence is required. The engineering department duty officer, assigned by the engineer officer, must be a qualified engineering officer of the watch.

In the temporary absence of the engineer officer, the duties of the engineer officer may be performed by the engineering department duty officer. If the engineer officer is on board, the duty officer reports the condition of the department to him prior to the eight o'clock reports. In the absence of the engineer officer, the duty officer makes the eight o'clock reports for the department to the executive officer (or command duty officer).

The engineering duty officer, in addition to such other duties as may be properly assigned him, is responsible for:

1. The alertness and proper performance of all men of the engineering watches.

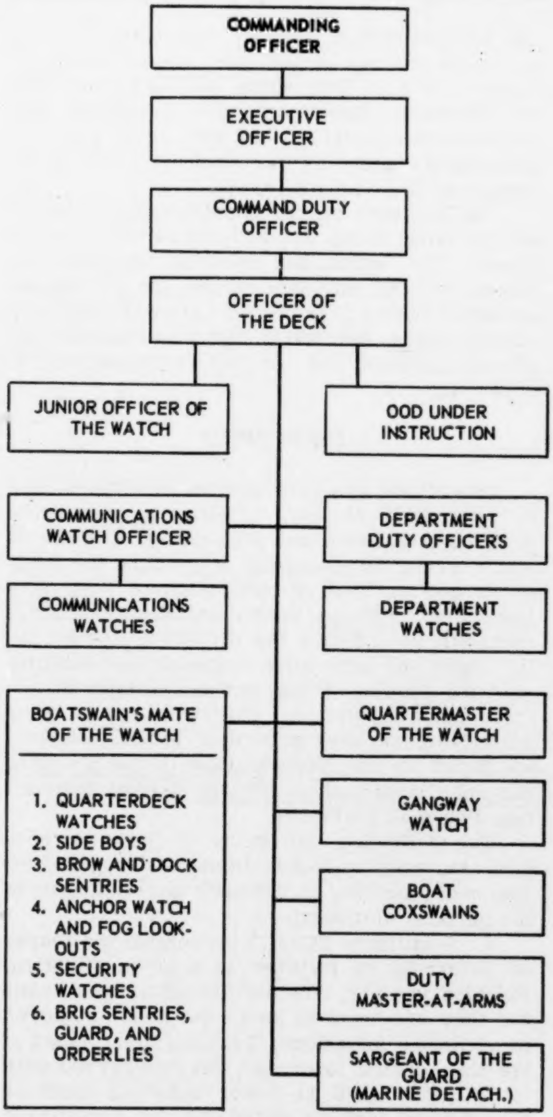

COMMANDING OFFICER
EXECUTIVE OFFICER
COMMAND DUTY OFFICER
OFFICER OF THE DECK
JUNIOR OFFICER OF THE WATCH
OOD UNDER INSTRUCTION
COMMUNICATIONS WATCH OFFICER
DEPARTMENT DUTY OFFICERS
COMMUNICATIONS WATCHES
DEPARTMENT WATCHES
BOATSWAIN'S MATE OF THE WATCH
1. QUARTERDECK WATCHES
2. SIDE BOYS
3. BROW AND DOCK SENTRIES
4. ANCHOR WATCH AND FOG LOOK-OUTS
5. SECURITY WATCHES
6. BRIG SENTRIES, GUARD, AND ORDERLIES
QUARTERMASTER OF THE WATCH
GANGWAY WATCH
BOAT COXSWAINS
DUTY MASTER-AT-ARMS
SARGEANT OF THE GUARD (MARINE DETACH.)
114.7

Figure 2-5.—Condition Watch V watch organization of a typical naval ship.

2. The safe and economical operation of all engineering machinery and systems in use.

3. The elimination of fire and flooding hazards and the prevention of sabotage.

4. The security of all engineering spaces. In order to determine the actual conditions that exist in the engineering spaces and to evaluate the performance of watch personnel, the duty officer must make frequent inspections of the engineering spaces.

5. The proper maintenance of all machinery operating logs and for writing and signing the engineering log for the period he is on duty.

The engineering department duty officer makes reports in the same manner as the engineering officer of the watch, except that when acting in place of the engineer officer, he is responsible for making the reports required of that officer. Engineering watch supervisors and the duty petty officers of the engineering divisions report to the duty officer in the performance of their duties.

A chief petty officer who is a qualified engineroom watch supervisor underway may be assigned a watch as the engineering department duty chief petty officer to assist the engineering department duty officer. The duty chief petty officer is normally assigned duty for the same period as the duty officer and reports to that officer in the performance of his duties.

Engineering Watches

The engineer officer is responsible for the condition watch V (in-port) watch organization of the engineering department. The type and amount of machinery and equipment of the engineering department in use in port is mainly governed by the services the department is required to furnish.

Regardless of what services are furnished by the department certain personnel are required to ensure the safe and efficient operation of the department when key personnel are temporarily absent. A responsible petty officer in the duty section of each engineering division must be designated to act in the absence of the division officer and leading petty officers of the division when the ship is in port. The division duty petty officer, in addition to other duties which may be properly assigned him, is required to:

1. Ensure that division watch personnel promptly and properly man assigned watch stations.

2. Inspect all spaces under the cognizance of the division. When inspecting watch stations, the petty officer should check on the alertness of the personnel on watch and ensure that proper operating procedures are being followed and that all applicable orders and instructions are obeyed. He must make certain that all spaces

are clean, free of fire and flooding hazards, and contain no unauthorized persons.

3. Muster division personnel and make reports as required.

The division duty petty officers report to the engineering department duty officer in the performance of their duties and for guidance and/or assistance in case of trouble or doubt. Generally, the division duty petty officer reports the condition of his division to the engineering department duty officer prior to 2000 each evening.

Certain engineering department personnel are required to furnish services or operate equipment regardless of other services required of the department. The engineering watches always assigned in port include the duty oil and water king (B division), the duty electrician's mate (E division—handles electrical trouble calls); the duty shipfitter (R division—handles sanitary system trouble calls); duty auxiliaryman (A division—handles heating, air conditioning, and ventilating trouble calls), motion picture operators (E division), boat engineers (qualified personnel of any engineering division).

The engineering department is usually required to furnish steam, electric power and lighting, and fresh water or feed water when the ship is in port. Only auxiliary machinery is needed to supply the required services and the necessary watch is referred to as the auxiliary watch. The auxiliary watch may consist of a security watch (regularly inspects idle machinery spaces and sounds voids), the fireroom watch (operates the boiler and associated machinery), the engineroom watch (operates the necessary auxiliary machinery in the enginerooms), the generator watch (operates the necessary ship service generators), the electrical watch (operates the necessary main electrical distribution switchboards), the evaporator watch (operates the distilling plant as necessary).

When the ship is receiving fresh water, steam, and electrical power from the pier or a ship alongside, the auxiliary watch is replaced with the cold iron watch in the machinery spaces. The cold iron watch generally consists of stationing a security watch in each engineroom and fireroom and assigning him the duty of preventing sabotage and damage from other causes by prohibiting entry to unauthorized personnel and by detecting and eliminating fire hazards, flooding hazards, and other potentially dangerous conditions. At the same time, cold iron watches are stationed in other important idle machinery spaces or the engineroom and/or fireroom watches periodically inspect additional spaces. A cold iron watch should be stationed in otherwise unoccupied idle firerooms and enginerooms underway as well as in port. A responsible petty officer must be assigned to supervise the cold iron watch.

The engineer officer should require posting of the daily watch list at least 24 hours in advance. The watch list must be approved and signed by the engineer officer or his representative before it is posted. After the engineer officer signs the watch list, no changes are allowed without his (or his representative's) approval.

DIRECTIVES

Directives are instructions or notices used by command at any echelon, to prescribe policies, organizations, procedures, or methods which serve as guides for controlling the decisions and actions of subordinates. The Navy Directives Systems, SecNav Instruction P5215.1 (revised) establishes the directive system for the Navy and sets forth a simple and uniform plan for issuing, filing, and maintaining directives under the system. Directives are assigned identifying numbers according to their subjects as listed in the Navy-Marine Corps Standard Subject Classification System, SecNav Instruction P5210.11 (revised).

The following definitions of policies, procedures, orders, instructions, and regulations are necessary for an adequate understanding of the purpose of directives.

1. A military POLICY prescribes the course of action to be followed in a given situation. Policies are best effected through written means for they are used to gauge the action required in recurring situations. Policies established at the top echelon are broad and general whereas those established at lower echelons must be specific and conform to the policies established by higher command.

2. A military PROCEDURE is a series of coordinated steps for the performance of functions.

3. A military ORDER is a formal oral or written command, issued by a superior officer to a subordinate, which establishes a rule or regulation or delegates authority for the performance of a function.

4. The term INSTRUCTION denotes the imparting of information concerning the methods

for the accomplishment of a mission and specifying the manner and conditions of performance in the execution of projects and programs.

5. A military REGULATION is a rule which sets forth standards governing or restraining the conduct of individuals.

Navy INSTRUCTIONS are directives that have a long term reference value and continue in effect until canceled by the originator. Instructions may contain information of a continuing nature or information that requires continuing action. Instructions are also used to direct action that cannot be completed in the near future or action that must be taken at a future date.

Navy NOTICES are directives that are applicable for a brief period of time (usually 6 months or less) and provide for automatic cancellation on a prescribed date or under a certain condition. Notices may require action that can be completed upon receipt or contain announcements and items of current interest.

Directives may be of the letter type or publication type. A publication differs from the letter type in that it is normally equipped with covers and contains a title page, a letter of promulgation, a record of changes page, a table of contents, and an alphabetical index of contents. The ship's organization and regulations manual is a publication type directive. Certain shipboard directives, however, are excluded from the directives system. The directives excluded are the captain's night order book, the ship's plan of the day, the engineer officer's night order book, the officer of the deck's standing order book, and the officer of the deck's memoranda.

The commanding officer promulgates the ship's directives system by the issuance of two instructions. One instruction prescribes the directives to be issued in the system, the responsibilities of originators of the directives, the directives control points and their functions, instructions for departmental and divisional use of the system, and standards for reproducing the ship's directives. The other instruction promulgates the distribution lists for the ship's directives.

The ship's directives system provides for the wide dissemination of the policies of the commanding officer, the executive officer, and the heads of departments, and supplies subordinate officers with a medium for the issuance of amplifying and supplementary instructions placing the policies in effect. The system ensures that the policies and procedures used in the administration and operation of the ship are continually in keeping with the plans and policies of the Navy Department and of fleet and type commanders by permitting integration of the ship's directives with those from higher authority.

Directives can be a very useful tool of the engineer officer when properly employed. He should prepare directives so that the policies and orders transmitted are clear, concise, and readily understood. He must use the format and arrangement for directives prescribed in The Navy Directives System, SecNav Instruction P5215.1 (revised). The engineer officer and other officers of the engineering department are required to maintain directives binders in accordance with the commanding officer's instructions. The binders should contain all directives (properly indexed and arranged) pertaining to the officers' jobs.

SHIP'S BILLS

Chapter 3 of the ship's organization and regulations manual contains the ship's bills that guide the assignment of personnel to duties or stations for the purpose of accomplishing certain functions. Each ship's bill is classified as an administrative, operational, or emergency bill. The watch, quarter, and station bill is an amplification of the ship's bills and is not included in the ship's organization and regulations manual.

Administrative bills are ship's bills that facilitate the assignment of personnel individually or by groups to stations or duties pertaining to routine overall administration of the ship. Administrative bills include the Personnel Assignment Bill, the Berthing and Locker Bill, and the Cleaning and Maintenance Bill.

Operational bills are ship's bills that facilitate the assignment of personnel individually or by groups to stations or duties pertaining to routine operations or evolutions of the ship. Operational bills include the Special Sea Detail Bill, Replenishment at Sea Bill, Rescue and Assistance Bill, Landing Party Bill, and Visit and Search, Boarding, and Prize Crew Bill.

Emergency bills are ship's bills that provide for the assignment of personnel individually or by groups to stations or duties to cope with emergencies. Emergency bills include the General Emergency Bill, Man Overboard Bill, and the Biological and Chemical Warfare Defense Bill.

Type commanders furnish ships of the type the information necessary to permit detailed assignment of personnel. The responsibility for and maintenance of each ship's bill is assigned to a key officer, usually a head of department. Each bill must supply sufficient guidance to the division officers to permit assignment of personnel by name to duties. Each bill must have a preface containing a statement of the purpose of the bill, an assignment of responsibility for maintenance of the bill, and information supplying background or guidance: a procedure containing all information and policies necessary to interpret the tabulated material and all special responsibilities of individuals with regard to planning, organizing, directing, or controlling the function or evolution to which the bill relates; and a tabulation showing assignments of individuals by billet or rate to stations or duties.

The engineer officer is responsible for the maintenance of the Rescue and Assistance Bill, General Emergency Bill, and Biological and Chemical Warfare Defense Bill. The Rescue and Assistance Bill provides a special organization equipped and qualified to render assistance to persons or activities outside the ship or to perform related functions. The General Emergency Bill provides optimum organization for counteracting major emergencies and for abandoning ship when necessitated by the nature of the emergency. The Biological and Chemical Warfare Defense Bill provides an organization and prescribes the procedures to minimize the effects of a biological or chemical attack. Samples of all ships' bills are available in Shipboard Procedures, NWP 50(A).

Each division officer is responsible for publishing and maintaining a summary of his assignments of personnel to stations and duties in accordance with the Battle Bill and each of the ship's bills. (The summary of personnel assignments is the division's Watch, Quarter, and Station Bill.) The Watch, Quarter, and Station Bill is arranged in standard tabular form with columns provided for entering each man's name and rate, data from the Battle Bill, and duties assigned under each of the ship's bills. A reusable panel, equipped with removable card strips that eliminate the need for reconstruction of the bill as changes occur, is available through the Navy supply system. The Watch, Quarter, and Station Bill should be prominently posted in a space which is frequented by all personnel of the division.

CHAPTER 3

DAMAGE CONTROL

The maintenance of optimum material and personnel readiness prior to damage and the employment of effective damage control measures after damage occurs are vital to the survival of a naval ship and comprise the basic objectives of the shipboard damage control organization. The term "damage control organization" as used in this book includes all elements of a ship's organization concerned with damage control. Damage control is not concerned with battle damage alone but with damage resulting from any major emergency, such as fire, collision, grounding, or explosion, regardless of when occurring.

This chapter presents information concerning the various aspects of damage control, the damage control organization and its objectives, and the damage control responsibilities of the engineer officer, or department head, and the damage control organization and its objectives, tion concerning damage control is available in Principles of Naval Engineering, NavPers 10788-A; NavShips Technical Manual, Chapters 9770 (77), 9880 (88), 9900 (90), and 9930 (93); and Battle Control (U), NWIP-50-1(B).

DAMAGE CONTROL ORGANIZATION

Principally there are two phases of damage control; the preventive phase and the repair or recovery phase. The objectives of the damage control organization are to cope with the preventive and repair or recovery phase. The preventive phase is concerned with personnel and maintenance of material in a state of optimum readiness, and requires the efforts of the personnel in all departments. The preventive phase of damage control is the responsibility of all hands.

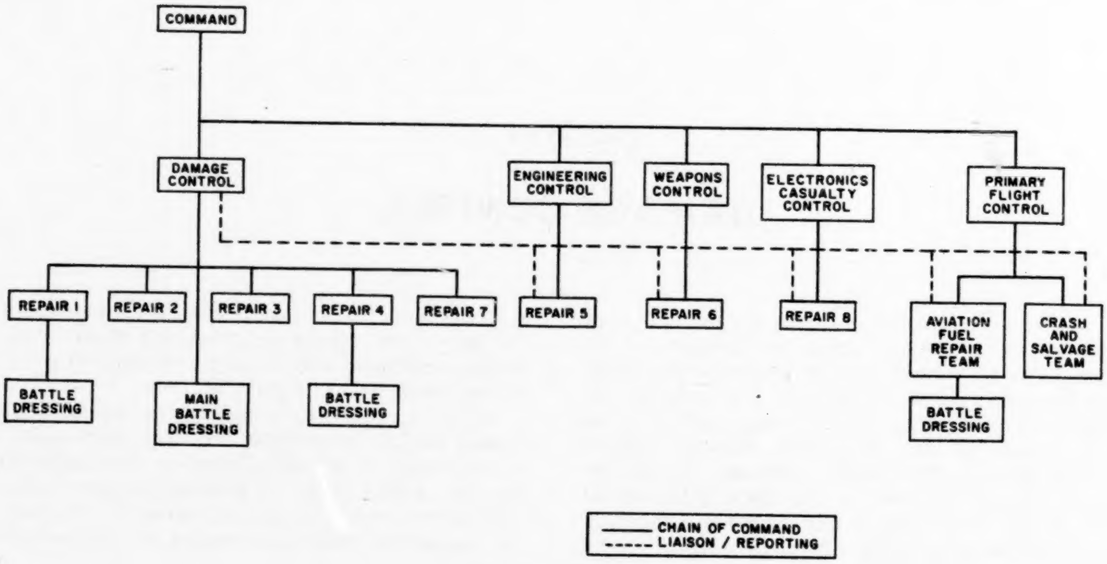
The repair or recovery phase of damage control occurs after damage has been sustained and requires that steps be taken to promptly restore the offensive and defensive potential of the ship. The repair or recovery phase is the responsibility of the damage control battle organization shown in figure 3-1.

Both the preventive and repair or recovery phases of damage control are vital to the safety of the ship. It should always be remembered that the action taken to control damage is the cumulative result of the organization, training, and material readiness during the preventive phase.

RESPONSIBILITIES OF THE HEAD OF DEPARTMENT

The engineer officer is directly concerned with both phases of damage control. As the damage control officer, he has certain responsibilities related to the action phase of damage control and as a head of department, he shares the responsibilities of the other heads of departments in the ship relating to the preventive phase of damage control.

Each head of department is responsible for the material condition of readiness within his department as prescribed by compartment checkoff lists provided by the damage control assistant. A compartment checkoff list for a typical compartment in a ship is shown in figure 3-2. Material conditions of readiness are shown in figure 3-3. Division officers should frequently check spaces assigned to them to ensure that maximum watertight integrity is being maintained. Each person in the department should be made aware of his responsibilities concerning the setting of all material conditions of readiness within the department. In addition, they must know what procedure to follow if it becomes necessary to alter a material condition of readiness in order to perform normal or emergency tasks. For detailed information concerning the alteration of material conditions


COMMAND
DAMAGE CONTROL
ENGINEERING CONTROL
WEAPONS CONTROL
ELECTRONICS CASUALTY CONTROL
PRIMARY FLIGHT CONTROL
REPAIR 1
REPAIR 2
REPAIR 3
REPAIR 4
REPAIR 7
REPAIR 5
REPAIR 6
REPAIR 8
AVIATION FUEL REPAIR TEAM
CRASH AND SALVAGE TEAM
BATTLE DRESSING
MAIN BATTLE DRESSING
BATTLE DRESSING
BATTLE DRESSING
CHAIN OF COMMAND
LIAISON / REPORTING

114.1

Figure 3-1.—Damage control battle organization.

of readiness, refer to Battle Control (U), NWIP-50-1(B).

The head of department is also responsible for:

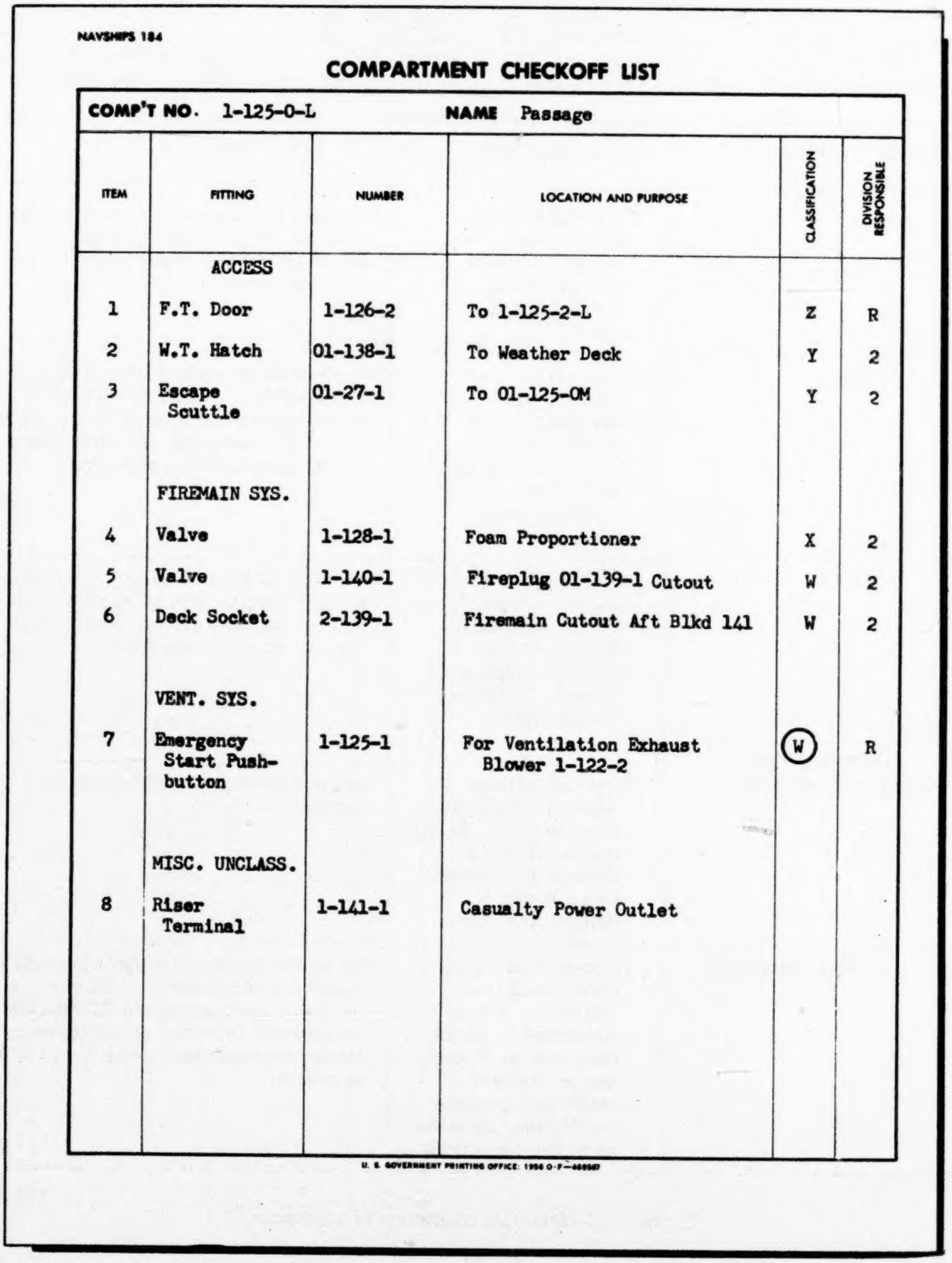
1. Watertight integrity discipline within his department. Personnel must be thoroughly indoctrinated in the importance of maintaining watertight integrity.

2. Inspection of departmental spaces in accordance with the hull report. The importance of periodic inspections must not be underestimated. The department head should insist that his division officers personally inspect their spaces. Inspections by division officers and their subordinates often disclose defects in watertight integrity which might otherwise go unnoticed until the ship is damaged. Prompt acknowledgement of, and action upon, reports of watertight integrity defects aid the development of an increased determination on the part of all hands to keep the ship as battle ready as possible.

3. Ensuring that damage control systems, fittings, and equipment are maintained in their proper locations and in good operating condition in accordance with planned maintenance system (PMS) requirements. This necessitates that personnel of the department be trained to recognize damage control systems, fittings, and equipment and know the procedures and precautions they must observe in order to properly discharge their responsibilities concerning the maintenance of such systems, fittings, and equipment.

4. Assignment of specific damage control duties to individuals within each division, including designation of a damage control petty officer. Each division is required to assign a responsible petty officer as damage control petty officer to act for the division in such matters as weighing portable fire extinguishers, making reports, inventorying damage control equipment within division spaces, and performing such other duties concerning damage control responsibilities of the division as may be assigned him by the damage control assistant or other competent authority. Personnel, as necessary, should be assigned to assist the division damage control petty officer in the performance of his duties.

5. Protection of material and equipment against heavy weather. The head of department ensures that personnel within his department carry out the provisions of the ship's heavy weather bill including properly securing damage



NAVSHIPS 184

COMPARTMENT CHECKOFF LIST

COMP'T NO. 1-125-0-L **NAME** Passage

ITEM	FITTING	NUMBER	LOCATION AND PURPOSE	CLASSIFICATION	DIVISION RESPONSIBLE
	ACCESS				
1	F.T. Door	1-126-2	To 1-125-2-L	Z	R
2	W.T. Hatch	01-138-1	To Weather Deck	Y	2
3	Escape Scuttle	01-27-1	To 01-125-OM	Y	2
	FIREMAIN SYS.				
4	Valve	1-128-1	Foam Proportioner	X	2
5	Valve	1-140-1	Fireplug 01-139-1 Cutout	W	2
6	Deck Socket	2-139-1	Firemain Cutout Aft Blkd 141	W	2
	VENT. SYS.				
7	Emergency Start Push-button	1-125-1	For Ventilation Exhaust Blower 1-122-2	Ⓦ	R
	MISC. UNCLASS.				
8	Riser Terminal	1-141-1	Casualty Power Outlet		

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Figure 3-2.—Compartment checkoff list.

control equipment against possible damage, and properly setting the required material condition of readiness within departmental spaces. Division officers should inspect their spaces before rendering reports to the head of department concerning the division's compliance with the requirements of the heavy weather bill. The head of department should inspect a representative

Condition of Readiness	Action to Be Taken	Remarks
XRAY	Close all fittings bearing the classification X and Ⓧ. Y, Z, and W fittings are open.	X fittings are normally closed except when actually in use. Condition XRAY may be set when in well protected harbors.
YOKE	Close all fittings bearing the classification Y and Ⓨ. Ensure that all X fittings are closed. Z and W fittings are open.	X fittings must remain closed during this condition. Condition YOKE is set underway and in port during wartime. Set underway and after working hours in port during peacetime.
ZEBRA	Close all fittings bearing the classification of Z, Ⓩ, and 🅉. Ensure that all X and Y fittings are closed. W fittings remain open.	Condition ZEBRA is set prior to entering and leaving port in wartime. Set, without further orders, upon manning general quarters stations.
DARKEN SHIP (A Modified Condition)	Close all fittings bearing the classification of 🅉. Ensure that all X and Y fittings are closed. Other Z and all W fittings are open.	Normal wartime nighttime steaming condition.
ZEBRA (Modified)	Fittings bearing the classification of red circle Z may be opened to permit distribution of food, use of sanitary facilities, provide ventilation, or other necessary functions.	May be set during prolonged periods of readiness for battle. Authority for deviation from condition ZEBRA must be obtained from the commanding officer through the damage control assistant.

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Figure 3-3.—Material conditions of readiness.

number of departmental spaces to ascertain compliance.

6. Ensuring that an immediate report be made to the Damage Control Assistant of any deficiency in damage control markings, devices, fittings, equipment, or material. If repairs are not effected promptly (after it has been ascertained that the damage was properly reported), the department head should insist upon follow-up action to determine the cause of delay.

7. Training personnel in damage control matters as directed by the executive officer. Attendance at damage control lectures, classes, and demonstrations should not be governed solely by whether personnel are members of repair parties. Knowledge of practical damage control must be required of all hands regardless of rating or assignment.

8. Assigning personnel to repair parties as required by the battle bill. Advise division officers to assign capable men to repair parties for ships may be damaged despite the employment of the most modern and effective methods and defensive weapons available.

9. Preparations to strip ship or clear for action in accordance with ship's instructions. Many items of equipage on board ship in peacetime represent luxuries which must be removed in time of war because they may adversely affect the military capabilities of the ship, are personnel or material hazards, or are unnecessary appendages which cannot be used. Department responsibility in regard to such items is set forth in the ship's organization and regulations manual. Articles of this nature are referred to as strip ship material. Department responsibilities which concern the reduction or elimination of fire hazards, the reduction or elimination of missile hazards, and the elimination of any potential interference with the control of firing or supply of ammunition to the batteries, are also set forth in the ship's organization and regulations manual.

10. Emphasizing self-sufficiency in all battle stations by on-the-job training in handling casualties to personnel and equipment. It should be easier for the engineer officer to realize the importance of his responsibility in this regard than for the other department heads since most of the engineering department battle stations are located in isolated spaces.

Designation of responsibility for damage control systems, fittings, and material is a prime requisite of optimum material readiness. Departmental and divisional responsibilities are defined in the ship's organization and regulations manual but frequently an overlapping of responsibility may occur between one or more departments. When this happens, the commanding officer should be informed so that he may resolve any doubts and ensure that department heads and their subordinates have a complete understanding of the damage control systems, fittings, and equipment under their cognizance. The very closest cooperation and understanding between the several departments of the ship is necessary to obtain effective maintenance.

As department head, the engineer officer is responsible under the commanding officer for the control of damage. This responsibility of the engineer officer includes the efficient functioning of the ship's damage control organization, and the maintenance of conditions of closure, watertight integrity, and damage control equipment. In small ships where no assistant to the engineer officer is assigned, the duties of the damage control assistant are performed by the engineer officer. He is also responsible for organizing Repair 5 in accordance with the ship's Battle Bill. He supervises the training of Repair 5 personnel and is responsible for their state of readiness. He assigns appropriate engineering ratings to other repair parties in accordance with the Battle Bill.

THE DAMAGE CONTROL ASSISTANT

The Damage Control Assistant (DCA) of a ship, when assigned, is responsible under the engineer officer for establishing and maintaining an effective damage control organization, and for supervising repairs to the hull, except as specifically assigned to another department or division. The DCA is charged with the over-all coordination of damage control matters and the control of list, trim, and stability of the ship. In an emergency, he exercises over-all control of the damage control problem, relying to the maximum extent practicable upon the technical advice and assistance of various departments. The dotted line in figure 3-1 denotes the liaison between the DCA and various departments in the damage control battle organization.

Prevention Phase Responsibilities

The responsibilities of the DCA relative to the preventive phase of damage control are as follows:

1. Prepare directives (for the commanding officer's signature) in connection with all damage control functions requiring the coordination of departments.
2. Submit to the planning board for training a schedule of all hands damage control training requirements, including battle problem requirements.
3. Prepare a damage control training syllabus and provide damage control instructors for the training of all hands.
4. Ensure standard damage control equipment (such as tools, portable lights, and portable pumps) is furnished to repair lockers and other prescribed locations throughout the ship and conduct periodic inspections of such equipment in accordance with the PMS.
5. Assign damage control ratings to various repair parties in accordance with the Battle Bill.
6. Make certain, by inspection in company with the cognizant division officer, that watertight integrity is maintained throughout the ship and that all divisions are maintaining a high degree of damage control readiness. During this inspection, the DCA should also:
    a. Ensure that compartment checkoff lists are posted in accordance with the damage control book.
    b. Ensure that all damage control markings, routes, stations, and labels are properly posted throughout the ship.
7. Ensure that an effective organization is always present for the execution of each of the ship's emergency bills.
8. Inform the engineer officer of any conditions or practices which lower the damage control readiness of the ship.
9. Organize repair parties 1, 2, 3, 4, and 7 in accordance with the ship's Battle Bill.
10. Direct the training of repair parties 1, 2, 3, 4, and 7, and personnel of damage control central.

Repair or Recovery Phase Responsibilities

The Damage Control Assistant is responsible for maintaining a damage control central with facilities and personnel for evaluating reports and making decisions to counteract the effects of damage to the ship's hull and appurtenances, coordinating repair parties, and keeping the commanding officer informed of major developments. A typical damage control central station aboard a large naval ship is shown in figure 3-4.

When general quarters stations are manned, the DCA prescribes the method and the route for transporting injured or contaminated personnel to battle dressing or decontamination stations. (Note: Battle damage stations are provided in close proximity, where appropriate.) He must select the safest and easiest method and the shortest safe route which will cause the least disruption of the material condition of readiness of the ship.

In the event of a nuclear weapons explosion, a biological attack, or a chemical attack, the DCA must determine from external radiological surveys the areas of contamination, establish the time that personnel can safely remain in these areas (safe stay time) and the time when areas will be safe for personnel to re-enter (entry time). He must provide for the reading of the dosage-measuring devices and furnish the medical and personnel officers with such information as they may require for their records.

Utilizing monitoring, detection, and sampling procedures, the DCA must keep the commanding officer informed of the location of contaminated areas, explosive hazards, or compartments containing insufficient oxygen to support life. When practicable, the general announcing system may be used to notify all hands of the location of such areas, hazards and compartments.

It should be apparent from the foregoing that the job of the DCA is a highly important one. He should be an officer who is versed in the basic principles of stability and buoyancy, the effects of damage, the methods of handling flooding, the requirements of practical damage control, and the procedures for radiological recovery of a ship after a nuclear weapons explosion. Most important of all, he must know his ship and the possible effects that damage may have upon it so that he will, in an emergency, be capable of properly estimating the situation and rendering the right decision as to the corrective measures that must be taken for survival of the ship.

Over-all ship survival measures which the DCA will be required to decide upon, may be intended to improve over-all stability, correct for off-center weight, restore reserve buoyancy, correct or improve trim, or relieve the stress on a damaged hull girder. The measure which will accomplish one or several of these objectives takes time and involves weight removals, additions, and shifts, and the restoration of boundaries. An operation undertaken to

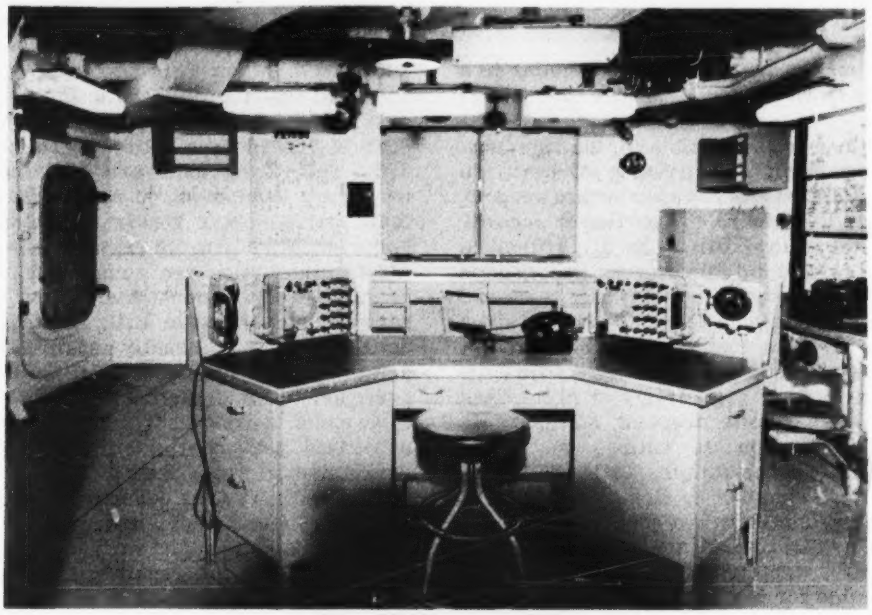

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Figure 3-4.—Typical damage control central in a large ship.

accomplish one objective may adversely affect one or all of the other objectives. The choice that the DCA makes will depend upon his knowledge of the ship's stability and subdivision characteristics, the nature and extent of the damage, and the effect that measures to accomplish one objective will have on the others.

Information concerning the nature and extent of the damage will generally come from repair parties and the accuracy of such information will depend upon how well the DCA has trained the repair parties in investigating damage and supplying the type of information that is needed. Other knowledge that the DCA will require in order to choose the proper corrective measure will have been acquired before damage occurs. After damage, there will be no time for calculations even if he were in the proper frame of mind for making them.

THE REPAIR PARTY

While the DCA initiates action for over-all ship survival measures, the repair party takes immediate local measures for the control of damage. Properly trained repair parties carry out such work automatically, correctly, and with speed. During battle, the local damage control measures undertaken by the repair parties may determine whether the ship remains in action, sinks, or retires to a haven.

The first requirement of an efficient repair party is that each person within the party must be highly trained in the technical aspects of the special field in which he will operate to control damage. Advantage should be taken of every opportunity to train repair parties. In addition to training the party as a group, consideration should be given to instructing individuals in the skills they will be required to utilize in an emergency. When developing the battle problem, the DCA should impose damage which will as realistically as possible involve the greatest number of repair parties on each hit.

Each repair party must be organized so that it is a self-sufficient unit in ready communication with the others and capable of positive action in control of the types of damage most likely to be encountered. A control station must be established where the repair party officer can receive, evaluate, and act on reports from repair party personnel and receive orders from damage control central concerning matters affecting buoyancy; list; trim; stability; watertight integrity; and nuclear, biological, and chemical (NBC) defense methods.

Repair parties assigned work peculiar to a single department must be under the direct supervision of officers of that department. The weapons officer is responsible for the organization and supervision of training of Repair 6 personnel. He also assigns appropriate weapon/deck ratings to other repair parties in accordance with the Battle Bill. The air officer is responsible for the organization and supervision of training of the aviation fuel repair team and of the crash and salvage team. He also assigns appropriate air department ratings to other repair parties in accordance with the Battle Bill. The medical officer organizes and supervises personnel of the battle dressing stations. He also assigns appropriate ratings to repair parties in accordance with the Battle Bill, furnishes medical supplies to first aid boxes and battle dressing stations, and conducts shipwide training in self-aid, first aid, and the medical aspects of NBC warfare defense. Other officers are responsible for the supervision and assignment of personnel of the repair parties in accordance with the Battle Bill.

The repair party must be organized and assigned sufficient personnel to provide for the relief of men engaged in arduous tasks, for battle messing, and for transition from one condition of readiness to another.

Each repair party must be capable of effecting repairs to sound powered telephone circuits; rendering first aid and transporting the injured; controlling and extinguishing all types of fires; detecting, identifying, and measuring dose and dose rate intensities; and decontaminating the effects of an NBC attack. Each repair party must be organized to evaluate and report correctly the extent of damage in its area. This may involve maintaining (1) a graphic display board showing damage, and action taken to correct disrupted or damaged systems, (2) deck plans showing locations of NBC contamination, location of battle dressings and personnel cleansing stations, and safe routes to them, and (3) a casualty board for visual display of structural damage. Repair 1, 2, 3, and 4 are assigned the duty of maintaining the ship's structural integrity and maneuverability. Repair 1, 2, 3, 4, and 5 are assigned maintenance of stability and buoyancy.

The extent of an area to be covered by a specific repair party and the watertight division of the ship may require that prescribed functions be made the joint responsibility of two or more repair parties or that certain repair parties be subdivided. When it is necessary to subdivide a repair party, the units thus formed are designated by the number of the main repair party followed by a letter as shown in figure 3-5. The repair units are dispersed with the necessary equipment to areas away from the main party. Each repair unit must maintain communication with its repair party.

Repair parties are comprised of personnel of various departments assigned in accordance with the ship's Battle Bill. Repair 1, the main deck repair party, usually consists of an officer and a chief petty officer from the weapons department (deck department on ships not having a weapons department), and petty officers and non-rated personnel from weapons and other departments; while Repair 5, the propulsion repair party, usually consists of an officer, and a chief petty officer, and petty officers, and non-rated men from the engineering department.

The size of the repair party and the extent of the area assigned to it will differ with the size and type of ship. An aircraft carrier will have a damage control battle organization similar to the one shown in figure 3-1. On ships with no aircraft or air groups embarked, there will be no need for primary flight control and its associated repair parties. In certain large ships the functions of the amidships repair party, Repair 4, and the propulsion repair party, Repair 5, may be shared by the two parties.

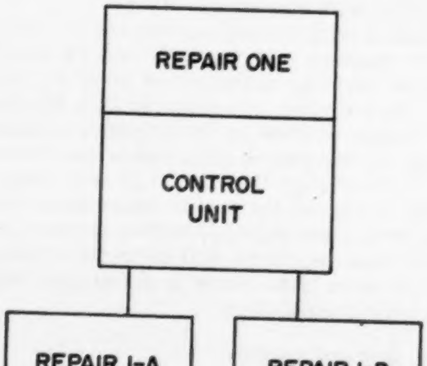

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Figure 3-5.—Organization of Repair 1 with two subdivisions.

When this combination of parties is employed, Repair 4 is designated as forward propulsion repair and Repair 5 as after propulsion repair.

In small aircraft carriers, Repair 7 and 8 are combined with Repair 1. Repair 2 and 3 may be combined with Repair 1 on small ships where the number of personnel available is below six men per repair party.

The ship's Battle Bill should be consulted for the assignment of repair party personnel, the number and location of repair parties in a particular ship, and additional information concerning specific functions of repair parties.

THE DAMAGE CONTROL LIBRARY

Officers of the engineering department and repair party officers must possess detailed knowledge of the ship's construction, characteristics, compartmentation, stability, and of the appurtenances and equipment placed on board the ship to prevent or control damage. The engineer officer should require that his officers avail themselves of every opportunity to acquire a thorough knowlege of the ship through the information contained in the publications which comprise the ship's damage control library.

Many of these publications are normally maintained in the log room or damage control central. Others, such as NWIP-50-1(B), Battle Control (U), and FXB-3B, Ship Exercises—Battle Problems, are classified publications and are normally maintained by the ship's custodian of registered publications.

THE DAMAGE CONTROL BOOK

The Damage Control Book is the most important source of information concerning the ship's damage control facilities and characteristics. Damage Control Books are issued by the Naval Ship Systems Command to all combatant, miscellaneous, and auxiliary ships over 220 feet in length (including floating drydocks) and to certain smaller fleet-operated ships. For other ships, Damage Control Books may be provided by the type commander or developed by the ship itself. The Naval Ship Systems Command maintains a record of all the books distributed and the books may not be transferred without the authority of NavShips. The engineer officer is normally the custodian of the Damage Control Books and, upon detachment, he must ascertain that all copies are accounted for and transfer custody to his relief. Additional Damage Control Books with diagrams lithographed in color may be requisitioned from the Naval Supply Depot, Philadelphia, Pennsylvania. Additional Damage Control Books with black and white diagrams should be requested from the planning yard of the ship. Copies of the Damage Control Book should be available in damage control central, main engine control, and at each of the repair party control stations.

Information contained in the Damage Control Book is in the form of text, tables, and diagrams concerning the ship's damage control facilities and characteristics of the ship's compartmentation, piping, and wiring systems. The engineer officer must make certain that the ship's copies of the Damage Control Book reflect the most recent installations. One copy should be assigned the title of "Master Copy" and kept current at all times so that it can be used to revise the other copies.

Alterations accomplished by ship's force or activities other than a naval shipyard are entered in the master copy of the Damage Control Book by the ship's force. Deletions on the diagrams are indicated by crossing out the deleted matter with red ink. No erasures should be made and it is not necessary to make any notes on the diagrams to indicate that the matter is to be deleted. Additions to the diagrams are made in accordance with the established color coding systems. Care must be taken to ensure that the location of the addition is correctly indicated. Emphasize the addition by circling the affected area with red ink. Changes in notes on the diagrams or the names of compartments are made by a note in the margin of the diagram. Revisions to the text are made with red ink.

At the commencement of each overhaul at a naval shipyard, the engineer officer should deliver the master copy, hand-corrected or relithographed for the preceding overhaul, and one other copy of the Damage Control Book to the shipyard with a request to have the volumes revised. Revisions should include all alterations made by the shipyard and ship's force during the overhaul as well as any previous revisions made by the ship's force. When the shipyard returns the volumes, the engineer officer should ascertain that they have been revised and accurately represent the ship at the time of its departure from the shipyard. Any discrepancies noted should be brought to the attention of the commanding officer of the ship.

OTHER PUBLICATIONS

There are many other publications which contain information necessary to the preventive and action phases of damage control. The Naval Ships Technical Manual is issued for the information and guidance of naval personnel responsible for or engaged in the operation, maintenance, or repair of equipment under cognizance of the Naval Ship Systems Command. Other publications supplied by NavShips include General Specifications for Ships of the U. S. Navy, the Booklet of Inclining Experiment Data, Booklet of General Plans, Schedule of Watertight Integrity Tests and Inspections, Booklet Plans of Machinery, and a List of Authorized Alterations.

Publications in the damage control library for which the ship and the type commander are responsible are the Ship's Organization and Regulations Manual and the Engineering Casualty Control Book. The ship is responsible for the Engineer Officer's Orders and Instructions, Damage Control Bills, Engineering Department Organization Book, ship's Repair Party Manual, and the Master Set of Compartment Checkoff Lists. The type commander supplies the Sequence Table for Burning Fuel Oil (which is the flooding effect diagram modified by special directives).

In the damage control library on recently constructed ships, the Ship Information Book replaces the General Information Book, Piping System Instruction Book, and Record of Electrical Installations and Electrically Operated Auxiliaries. However, these publications are still in the damage control libraries of older ships. The Ship Information Book is prepared by the building shipyard and issued by the Naval Ship Systems Command.

The publications which complete the damage control library are the Coordinated Shipboard Allowance List; First Aid Bulletins; various Fleet and Type Directives on Damage Control; Sound-Powered Telephone Talker's Manual (NavPers 14005-A); Principles of Radiation and Contamination Control (NavShips 250-341-3); Radiological Health Protection Manual, NavMed P-5055 (1964); copies of the hull plans; and the manufacturer's technical manuals for damage control equipment.

DAMAGE CONTROL BILLS

The DCA is responsible for the preparation, completeness, and currency of the damage control bills. These bills are necessary to the damage control organization for they outline the procedures and instructions for operating the various systems in conformity with the material readiness condition in effect. The DCA of a newly commissioned ship should complete all damage control bills as soon as possible. The DCA of a ship which has been in commission for a number of years should periodically examine his damage control bills to determine if they are current, accurate, and adequate. In order to be effective, the bills must be promptly revised to reflect changes made in the systems by the accomplishment of authorized alterations.

Instructions for the preparation of a ship's bills are contained in NWP-50(A), and these instructions should be carefully followed when preparing the damage control bills. The Damage Control Book is a source of considerable information for the preparation of the bills, especially concerning the various systems and the classifications for important closures.

If a type repair party manual is available for his ship, the DCA will have a relatively simple job preparing the damage control bills. In this case, the job will consist primarily of adapting the bills in the type repair party manual to fit his ship.

The damage control bills include the damage control communications bill, casualty power bill, watertight door and hatch bill, air conditioning bill, ventilation bill, compressed air bill, voice tube bill, and the counterflooding bill (for ships where applicable). When completed, the damage control bills form a part of the contents of the ship's repair party manual.

The ship's repair party manual must also include the following material:

1. A listing of the important features of each repair party area including the location of machinery, storage spaces, repair lockers, and magazines.
2. The protective measures involving material and personnel with respect to imminent air attack, surface attack, underwater attack, collision, and NBC attack.
3. The methods of investigating damage and the precautions to be observed.
4. The means of reporting damage.
5. A complete description of damage control central listing location, equipment installed, communications, personnel billets (including duties and responsibilities), and publications available (plans, diagrams, plates, and manuals).

6. The chain of command diagram.
7. The location of secondary damage control central.
8. A complete description of repair parties including personnel billets (duties and responsibilities), publications, and repair units (where applicable).
9. Complete descriptions of the methods of fighting fire, controlling flooding, repairing damage in action (shoring, pipe patching, and welding), controlling NBC contamination (monitoring, reporting, and decontamination of material), handling personnel casualties (first aid and decontamination), and utilizing primary and alternate methods of providing emergency service to vital systems (casualty power, emergency communications, and jumpers to restore firemain or magazine sprinkling service).

The ship's repair party manual must be properly indexed so that the information contained therein can be easily located. A copy of the ship's repair party manual should be available at each repair party control station (repair party locker), damage control central, main engine control, bridge, and quarterdeck.

Although damage control bills usually take a general form as outlined in NWIP 50-1(B), no rigidly fixed one is prescribed. Therefore, the following outline is presented as a suggested form to be followed in drawing up an effective damage control bill:

A. Statement of purpose, or object of bill.
B. Description of system, or systems, including their important parts.
C. Method and procedure of operation to be followed for damage control purposes.
D. List, classification, and cognizance of fittings.
E. Simplified diagram, or diagrams, illustrating the most important points covered under A, B, C, and D.

In following such an outline, and by using available information, it is believed that each bill can be clear to the ship's personnel. It is considered necessary that every officer, as well as every man, in the ship should be familiar with all such bills; and that all members of the repair parties should have a thorough knowledge concerning them. Copies of all bills should be widely distributed among officers, key petty officers, and at repair stations.

WATERTIGHT INTEGRITY

The original watertight integrity of a naval ship is determined by its design and the skill and thoroughness of its builders and inspectors. By design, each naval ship is intended to be divided into watertight compartments to an extent compatible with its mission. This watertightness will be established if the builders are skillful and rigidly adhere to the general specifications for ships when constructing the hull and installing bulkheads, decks, access closures, ventilation ducts, electric cables, piping, rotating shafts, and associated fittings. When the engineer officer assigned to a ship under construction, a newly constructed ship, or a reactivated ship is aware of any deletions or defects in the construction of the ship which adversely affect its watertightness, he must report such a fact to his commanding officer or the supervisor of shipbuilding, whichever may be appropriate.

Negligence, storm damage, collision, stranding, and enemy action are potential destroyers of the original watertight integrity of a ship. It is the responsibility of the engineer officer to guard the watertight integrity of his ship against impairment through negligence and to ensure when it is damaged, from whatever cause, that proper repairs are made as quickly as possible.

Impairment of the watertightness of a compartment resulting from negligence generally appears as corrosion; holes in, or improper fit of joints of structural members resulting from lack of preventive maintenance, careless repairs, or careless alterations; and as defective piping, cabling, ventilation duct, and associated fittings. In order to prevent such occurrences, the engineer officer must not allow any unauthorized alterations or repairs to the boundaries of watertight compartments and he should insist upon strict compliance with the schedule of watertight integrity tests and inspections issued by the Naval Ship Systems Command.

INSPECTIONS AND TESTS

Strict adherence to a schedule of periodic inspections and tests affords the best insurance of the watertight integrity of the ship. The Naval Ship Systems Command issues a schedule of watertight integrity tests and inspections for all ships in commission. This schedule lists each compartment subject to the test or inspection, specifies which type of test or inspection applies, and states the frequency with which the test or inspection should be made. The schedule includes the leakage inspection, the visual inspection, and air tests.

The leakage inspection involves the observation of oil and water leaks from tanks into adjoining dry compartments. The Navships schedule requires that the bulkheads and decks separating oil and water tanks be inspected for leaks at least once every six months. Exercise particular care to note evidence of leakage which occurs only when a tank is filled to capacity. Visible leakage is usually caused by loose rivet heads and poorly calked plate laps, plate stiffeners, and bounding angles. Where possible, such leaks should be repaired by ship's force. Repairs beyond the capacity of ship's force should be requested at the next shipyard, tender, or repair ship availability.

The NavShips schedule requires that periodic visual inspections be made of some compartments normally incapable of test by air pressure because of the presence of permanent openings to the atmosphere. Compartments listed for this type of inspection are the firerooms, enginerooms, motor rooms, chain lockers, uptake enclosures, and similar spaces in some ships. These areas are extremely important parts of the ship's watertight subdivision and must be given the most careful and scrupulous scrutiny. The inspection is made by closing and darkening the compartment on one side of the boundary to be inspected, stationing an observer therein, and brilliantly lighting the other side. Conscientious examination of the darkened side of the boundary should reveal the presence of any visible defects. Different inspectors should make successive periodic examinations in order to avoid repeatedly overlooking defects. A checkoff list of fittings such as doors, hatches, manholes, deck drain valves, voice tube covers, ventilation-duct covers, and like fittings must be maintained and all such fittings in the boundary being inspected must be carefully examined and the results of the inspection noted in the checkoff list. It must be emphasized that the visual inspection rather than air test does not connote a relative lack of importance.

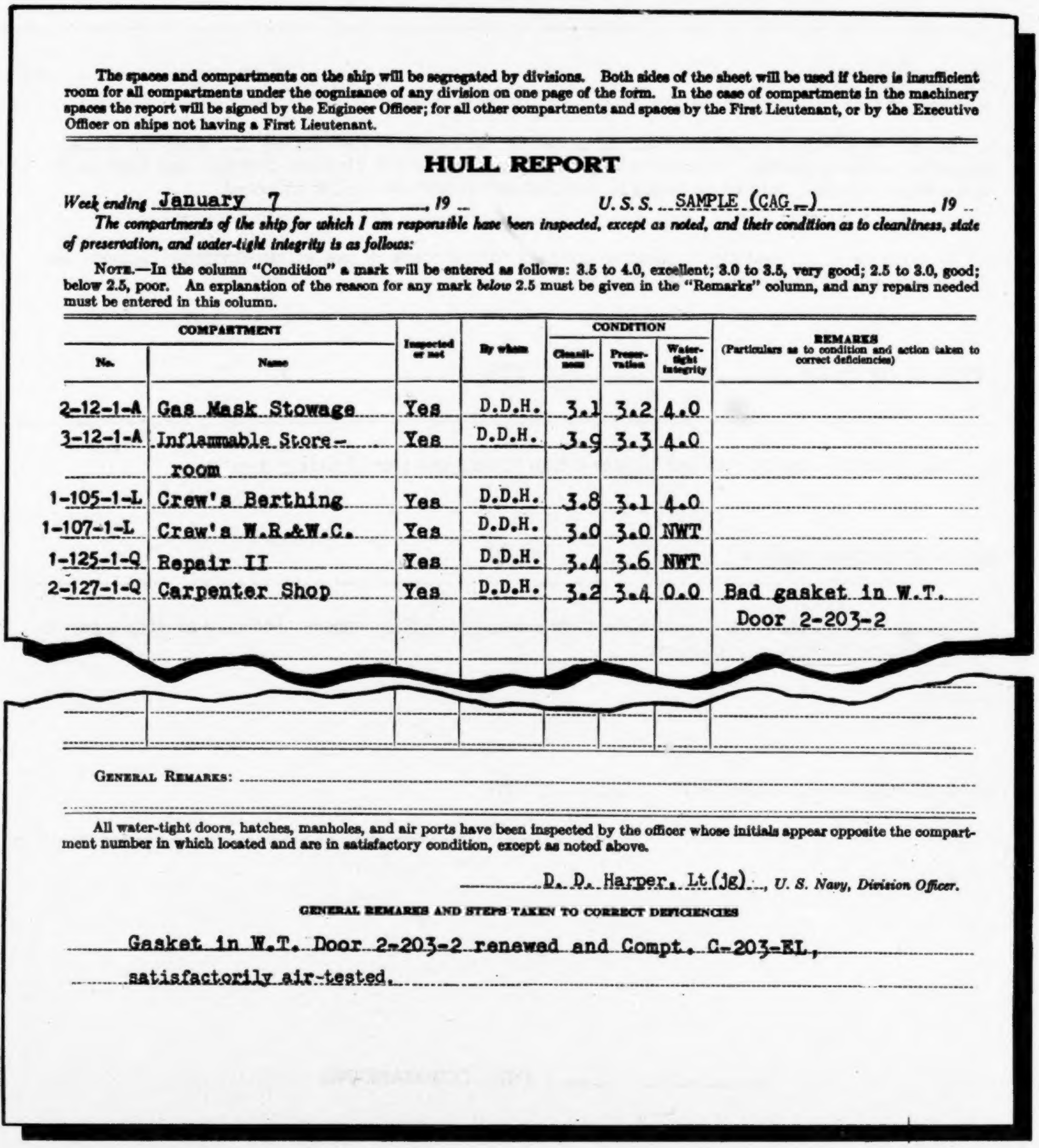
Presently, the air test is the most practicable method of completely determining the degree of watertightness of compartments not containing oil or water. Except when modified by NavShips, compartments listed in the schedule for air testing must be tested at least once every eighteen months. No air tests should be made on compartments not listed in the schedule except as directed or approved by NavShips. Compartments to be tested are normally divided into six groups and a different group is tested each quarter. In this manner, each compartment is subjected to an air test within the period of eighteen months. The test pressure and the allowable pressure drop over a specified period are given in the schedule. Test pressure must never exceed the pressure specified but must equal that specified except when conditions will not permit such pressures, in which case a report thereof must be made to NavShips.

Air tests are conducted in accordance with the procedure outlined in NavShips Technical Manual. Air tests shall be conducted by the ship's force except in the case of submarines and other ships specifically designated by NavShips. Whenever a ship's force, repair ship, tender, or naval shipyard has performed corrective maintenance which might affect the watertight integrity of a compartment listed in the schedule of air tests, the compartment must be air tested and the repairs effected, together with the results of the air test, must be recorded. Repair activities must furnish the ship with a report of any tests made. Air tests by repair activities are acceptable in lieu of the periodic tests required by NavShips.

In the case of a newly commissioned ship, the aforementioned periodic tests and inspections commence at the beginning of the quarter following the quarter in which the ship reports for service. Ships which are not provided with the NavShips schedule of tests and inspections should request them from the Naval Ship Systems Command.

Additional insurance of the watertight integrity of the ship is provided by periodic inspections of all compartments with the exception of certain tanks and voids. This inspection is most effective when made by the division officers. The inspecting officer submits a report (hull report) of the material condition of the compartments inspected, as to cleanliness, state of preservation, and condition of damage control fittings and equipment, to the commanding officer. The frequency with which the inspection is conducted is determined by the type commander.

A form similar to the one shown in figure 3-6, should be used for the inspecting officer's report to the commanding officer. The reverse side of the report should contain the entries shown in figure 3-7. Division officers should submit the hull reports to the commanding officer via their department head, the DCA and the engineer officer. The DCA should prepare a form similar to the one shown in figure 3-8 and submit it with the hull reports to the engineer officer. The engineer officer should examine



The spaces and compartments on the ship will be segregated by divisions. Both sides of the sheet will be used if there is insufficient room for all compartments under the cognizance of any division on one page of the form. In the case of compartments in the machinery spaces the report will be signed by the Engineer Officer; for all other compartments and spaces by the First Lieutenant, or by the Executive Officer on ships not having a First Lieutenant.

HULL REPORT

Week ending January 7, *19* ..   *U. S. S.* SAMPLE (CAG ..), *19* ..

The compartments of the ship for which I am responsible have been inspected, except as noted, and their condition as to cleanliness, state of preservation, and water-tight integrity is as follows:

NOTE.—In the column "Condition" a mark will be entered as follows: 3.5 to 4.0, excellent; 3.0 to 3.5, very good; 2.5 to 3.0, good; below 2.5, poor. An explanation of the reason for any mark *below* 2.5 must be given in the "Remarks" column, and any repairs needed must be entered in this column.

COMPARTMENT		Inspected or not	By whom	CONDITION			REMARKS (Particulars as to condition and action taken to correct deficiencies)
No.	Name			Cleanliness	Preservation	Water-tight integrity	
2-12-1-A	Gas Mask Stowage	Yes	D.D.H.	3.1	3.2	4.0	
3-12-1-A	Inflammable Store-room	Yes	D.D.H.	3.9	3.3	4.0	
1-105-1-L	Crew's Berthing	Yes	D.D.H.	3.8	3.1	4.0	
1-107-1-L	Crew's W.R.&W.C.	Yes	D.D.H.	3.0	3.0	NWT	
1-125-1-Q	Repair II	Yes	D.D.H.	3.4	3.6	NWT	
2-127-1-Q	Carpenter Shop	Yes	D.D.H.	3.2	3.4	0.0	Bad gasket in W.T. Door 2-203-2

GENERAL REMARKS:

All water-tight doors, hatches, manholes, and air ports have been inspected by the officer whose initials appear opposite the compartment number in which located and are in satisfactory condition, except as noted above.

D. D. Harper, Lt (jg), *U. S. Navy, Division Officer.*

GENERAL REMARKS AND STEPS TAKEN TO CORRECT DEFICIENCIES

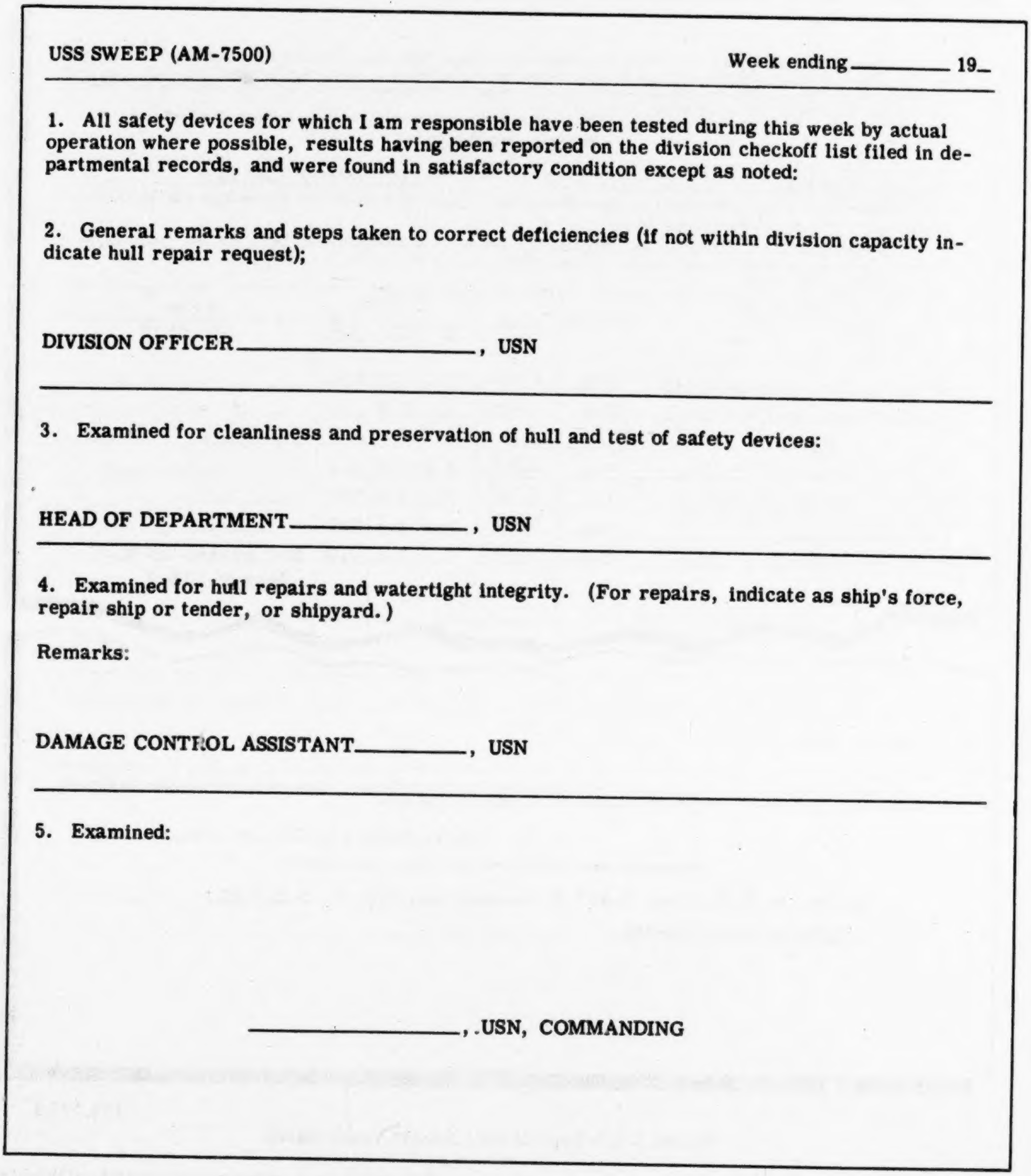
Gasket in W.T. Door 2-203-2 renewed and Compt. C-203-EL, satisfactorily air-tested.

103.124.1

Figure 3-6.—Typical Hull Report Form (face).

the reports, sign the accompanying form, and forward the reports and form to the commanding officer via the executive officer.

Using the type commander's Standard Repair Party Manual and ship's COSAL to determine the allowance of damage control equipment, the



USS SWEEP (AM-7500) Week ending ________ 19__

1. All safety devices for which I am responsible have been tested during this week by actual operation where possible, results having been reported on the division checkoff list filed in departmental records, and were found in satisfactory condition except as noted:

2. General remarks and steps taken to correct deficiencies (if not within division capacity indicate hull repair request);

DIVISION OFFICER ________________, USN

3. Examined for cleanliness and preservation of hull and test of safety devices:

HEAD OF DEPARTMENT ________________, USN

4. Examined for hull repairs and watertight integrity. (For repairs, indicate as ship's force, repair ship or tender, or shipyard.)

Remarks:

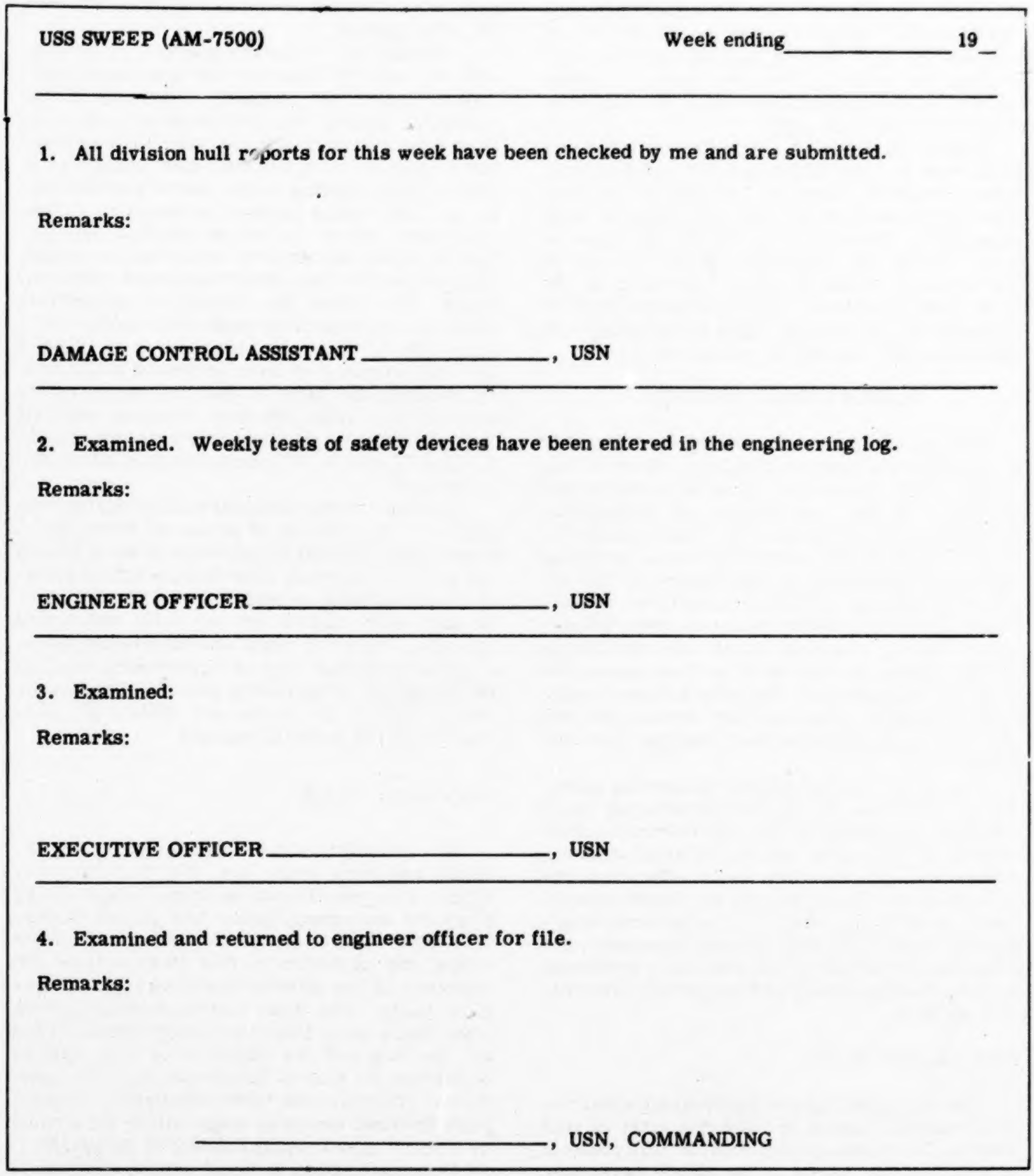
DAMAGE CONTROL ASSISTANT ____________, USN

5. Examined:

________________, USN, COMMANDING

103.124.2

Figure 3-7.—Typical Hull Report Form (back).



USS SWEEP (AM-7500) **Week ending ______________ 19__**

1. All division hull reports for this week have been checked by me and are submitted.

Remarks:

DAMAGE CONTROL ASSISTANT ______________, USN

2. Examined. Weekly tests of safety devices have been entered in the engineering log.

Remarks:

ENGINEER OFFICER ______________, USN

3. Examined:

Remarks:

EXECUTIVE OFFICER ______________, USN

4. Examined and returned to engineer officer for file.

Remarks:

______________, USN, COMMANDING

103.124.3

Figure 3-8.—Typical Hull Report Transmittal Form.

DCA/division officers should inventory the damage control equipment once each month, in accordance with the ship's PMS schedule. Report of the inventory may be made on a form similar to the one shown in figure 3-9 and submitted with the hull report.

Inspection alone is not sufficient to ensure readiness to control damage. Remedial action, where required, must be initiated by the division officer concerned. He must submit work requests for the correction of all the deficiencies noted during the inspection which are beyond the capacity of his division. Furthermore, he must make certain that measures are undertaken immediately to correct those deficiencies that are within the capacity of his personnel.

RADIOLOGICAL DEFENSE

The sole objective of radiological defense is to maintain the health and fighting effectiveness of the ship's personnel. This objective is best achieved by the employment of radiological countermeasures designed to reduce shipboard radiation hazards to acceptable levels. Radiation hazards of shipboard contamination can last for a considerable period of time; therefore, casualties may not only occur among unprotected personnel during and immediately after fallout but among persons attempting to perform subsequent essential operations. For this reason, radiological defense measures are divided into two phases: the emergency phase and the recovery phase.

The DCA's responsibility concerning radiological defense begins with instituting those preparatory measures that will reduce the effort necessary to carry out radiological countermeasures and increase their efficiency and effectiveness. These measures include incorporating radiological defense actions in the ship's general emergency bill, training personnel, and planning and providing the necessary equipment and supplies for repair parties and decontamination stations.

EMERGENCY PHASE

The emergency phase starts with the warning of a nuclear attack or with the start of such attack. The primary objective of this phase is survival of the ship and the ship's personnel. During the emergency phase, survival of the ship requires collective action and is a command decision while survival of personnel mainly requires individual action and consists of taking adequate shelter.

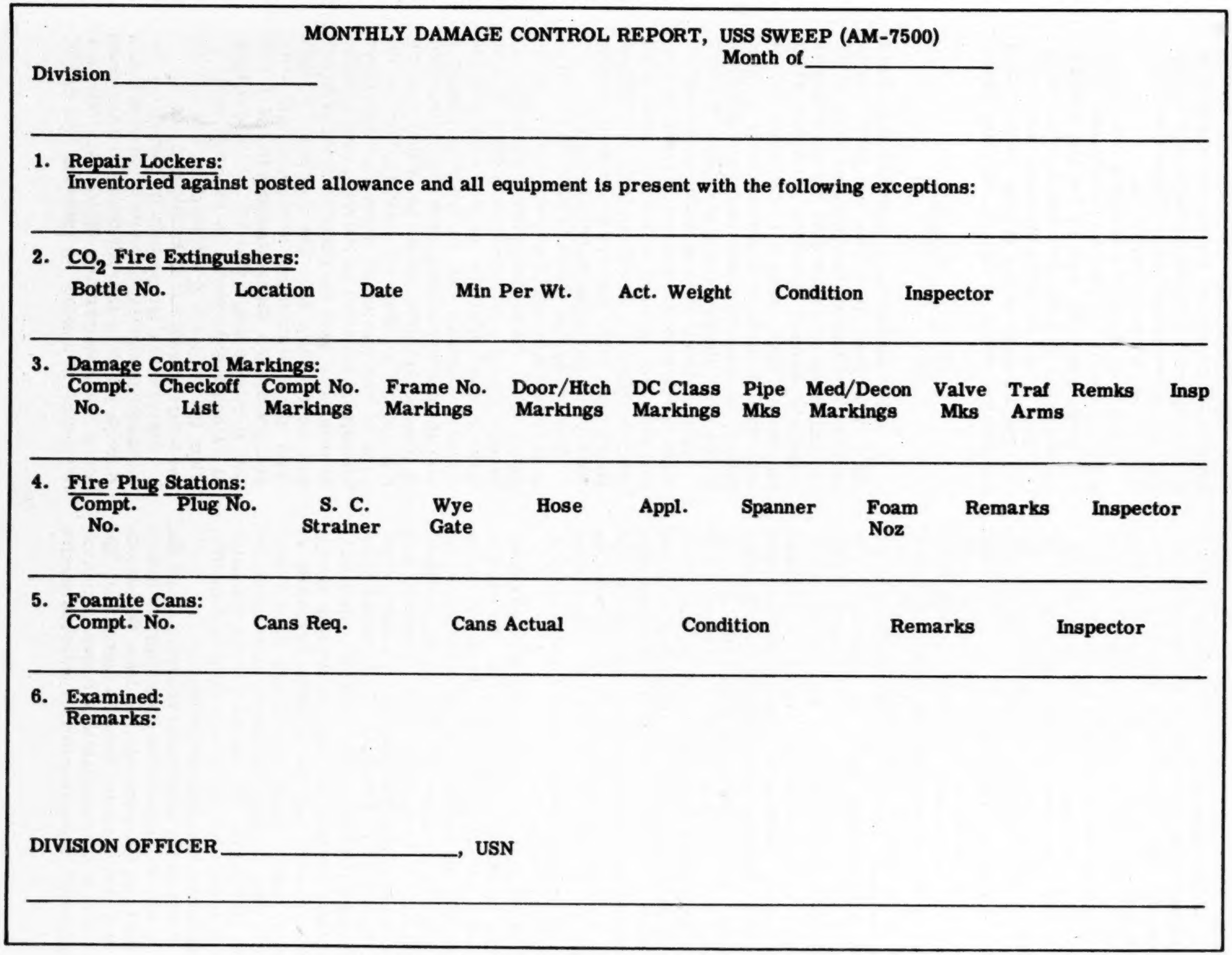
Radiological countermeasures consistent with the tactical situation are necessary when fallout cannot be avoided. Operation of the washdown system will provide some protection during the emergency phase since the washdown water carries over the side most of the radioactive fallout landing on the ship's exposed surfaces. The most important measure in the emergency phase is taking adequate shelter. Spaces within the armored area of major combat ships afford the best shielding against radiation. Spaces not within the armored area provide protection sufficient for moderate exterior radiation levels. The next measure is to prevent the contamination of interior spaces of the ship by sealing the ship to the maximum extent practicable. This measure requires that all fittings and vents or blowers bearing the classification of circle W (circle William) be closed or stopped.

Another useful countermeasure during this phase is the rotation of personnel between exposed and protected locations in order to extend the period of tactical effectiveness before maximum permissible exposures are reached (assuming such spaces are not fully exposed to fallout). Whenever replacements are not available, the radiation dose to topside personnel can be minimized by providing shelter stations near battle stations for occupancy while such personnel are not actively engaged.

RECOVERY PHASE

The recovery phase consists of the operational recovery stage and the final recovery stage. The operational recovery stage occurs after the emergency phase has passed (sometime after fallout on the ship ceases). In most cases, the objective of this stage will be the recovery of the ship's operations on a temporary basis. The final recovery stage occurs when there is no longer an urgent tactical need for the ship and the objective of this stage is to restore the ship to its normal operating condition. Normally the tasks required to accomplish the final recovery stage will be performed by a shore based repair facility or shipyard.

Decontamination is the principal radiological countermeasure employed during the recovery phase. Use of the ship's washdown system during the emergency phase will result in the removal



MONTHLY DAMAGE CONTROL REPORT, USS SWEEP (AM-7500)

Month of________________

Division__________________

1. **Repair Lockers:**
Inventoried against posted allowance and all equipment is present with the following exceptions:

2. **CO_2 Fire Extinguishers:**

Bottle No.	Location	Date	Min Per Wt.	Act. Weight	Condition	Inspector

3. **Damage Control Markings:**

Compt. No.	Checkoff List	Compt No. Markings	Frame No. Markings	Door/Htch Markings	DC Class Markings	Pipe Mks	Med/Decon Markings	Valve Mks	Traf Arms	Remks	Insp

4. **Fire Plug Stations:**

Compt. No.	Plug No.	S. C. Strainer	Wye Gate	Hose	Appl.	Spanner	Foam Noz	Remarks	Inspector

5. **Foamite Cans:**

Compt. No.	Cans Req.	Cans Actual	Condition	Remarks	Inspector

6. **Examined:**
Remarks:

DIVISION OFFICER____________________, USN

Figure 3-9. — Typical Damage Control Monthly Inventory Report.

103.125

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of some radioactive contamination from topside surfaces but many areas will require manual decontamination before they can be safely occupied for any considerable period of time. Personnel who have become contaminated as a result of manning exposed stations, carrying out decontamination procedures, or from whatever cause will also require decontamination.

Before essential tactical functions can be resumed following the emergency phase and before manual decontamination of some areas can commence, some exposed locations will have to be manned. In order to determine the feasibility of continued occupancy or immediate reoccupancy of such areas, a gross monitoring survey is made of topside action stations and any occupied below decks action stations (fireroom stations near boiler air systems) which may have been severely contaminated. Data concerning the location and the radiation intensity, in roentgens per hour (r/hr), of contaminated areas resulting from the gross survey and subsequent detailed surveys is relayed to damage control central where the DCA plots the contaminated areas, determines the entry time and safe stay time, and reports this information to the commanding officer. The equipment available at damage control central in some ships permits simultaneous transmission of this information to all hands. On other ships the information must be relayed via the bridge. The former method is best for it greatly reduces the possibility of error.

As information form monitoring teams is received in damage control central, the contaminated areas are plotted on a chart of the ship. The time the intensity was recorded as well as the reading is noted. In addition, for weatherdeck areas, the numbers of the frames forming the limits of the contaminated area are plotted.

The DCA will be required to estimate several radiological factors after receipt of data from command control and the monitoring teams. These factors include radiation intensities at future times, penetration doses to personnel performing various operations, entry times, and safe stay times. The accuracy of the estimates depends upon the action to be taken and the time available to make the estimates.

Early in the operational recovery stage, the DCA will be required to make rapid estimates of safe stay time and potential dose. For periods of less than one hour, the DCA may assume that intensity will be constant even though gamma radiation will decrease with time due to radioactive decay and weathering. The DCA will receive information necessary for the estimates from monitoring teams (location and intensity of radiation) and command control (allowable radiation dose for recovery personnel).

A quick estimate of a safe stay time of less than one hour's duration may be figured by dividing the allowable dose by the last intensity measurement if taken less than one hour prior to entry. Thus, when the allowable dose is 25r and the intensity of the reading (taken within one hour of entry) is 125 r/h, safe stay time =

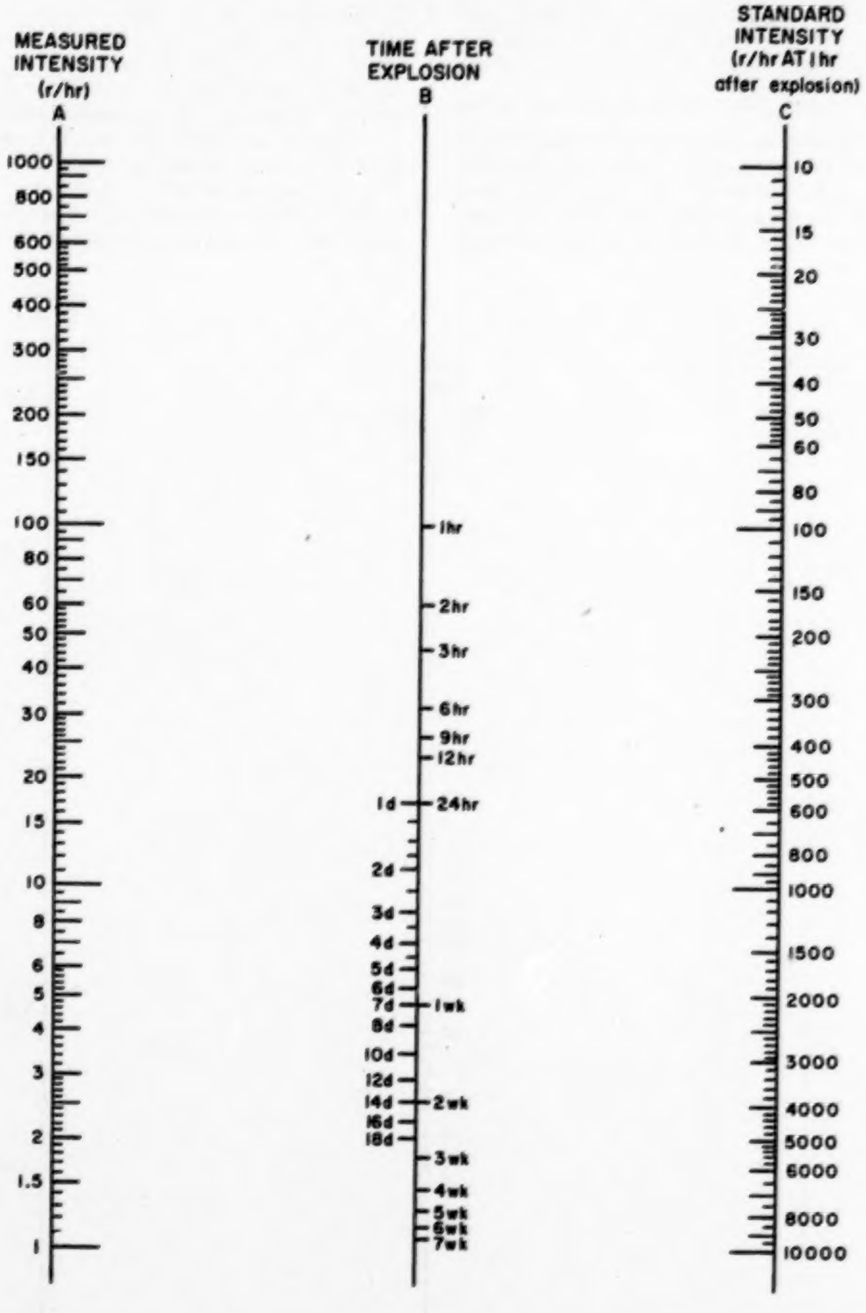
$$\frac{25}{125} = 0.2 \text{ hr} (12 \text{ min.})$$

A rapid estimation of potential dose for a short stay time (less than one hour) can be made by considering the potential dose as the product of the allowable dose and the stay time (using the decimal equivalent of the fraction of the hour). Thus, when it is estimated that it will take 15 minutes to accomplish a certain task in an area where the intensity of radiation is 100 r/hr, the potential dose = 100 x 0.25 = 25r.

Later, when greater accuracy is desired and more deliberation is practicable, certain graphical aids may be used in order to obtain more precise estimates. In addition to the nomographs shown here, other aids are available in chapter 9900 (90) of NavShips Technical Manual.

The nomograph shown in figure 3-10 can be used to estimate radiation intensities for a given future time. First, determine the standard intensity. Given a measured intensity of 20 r/hr taken 3 hours after the nuclear explosion, the standard intensity can be found by placing a straightedge on the nomograph (fig. 3-10) so that it bisects the given values on scales A and B and extends to intersect scale C. Thus (at the point of intersection on scale C), the standard intensity is indicated as 100 r/hr. Next, in order to determine what the intensity of the radiation will be 12 hours after the explosion (9 hours after the measurement was taken), place the straightedge on the nomograph (fig. 3-10) so that it bisects scale C at 100 r/hr and scale B at 12 hours and extends to intersect scale A. Thus (at the point of intersection on scale A), the future intensity is indicated as 5 r/hr.

Entry times for periods of continuous occupancy immediately after the nuclear explosion through two days afterwards can be determined using the nomograph in figure 3-11. Given a stay time of 5 hours, an allowable dose of 25r,



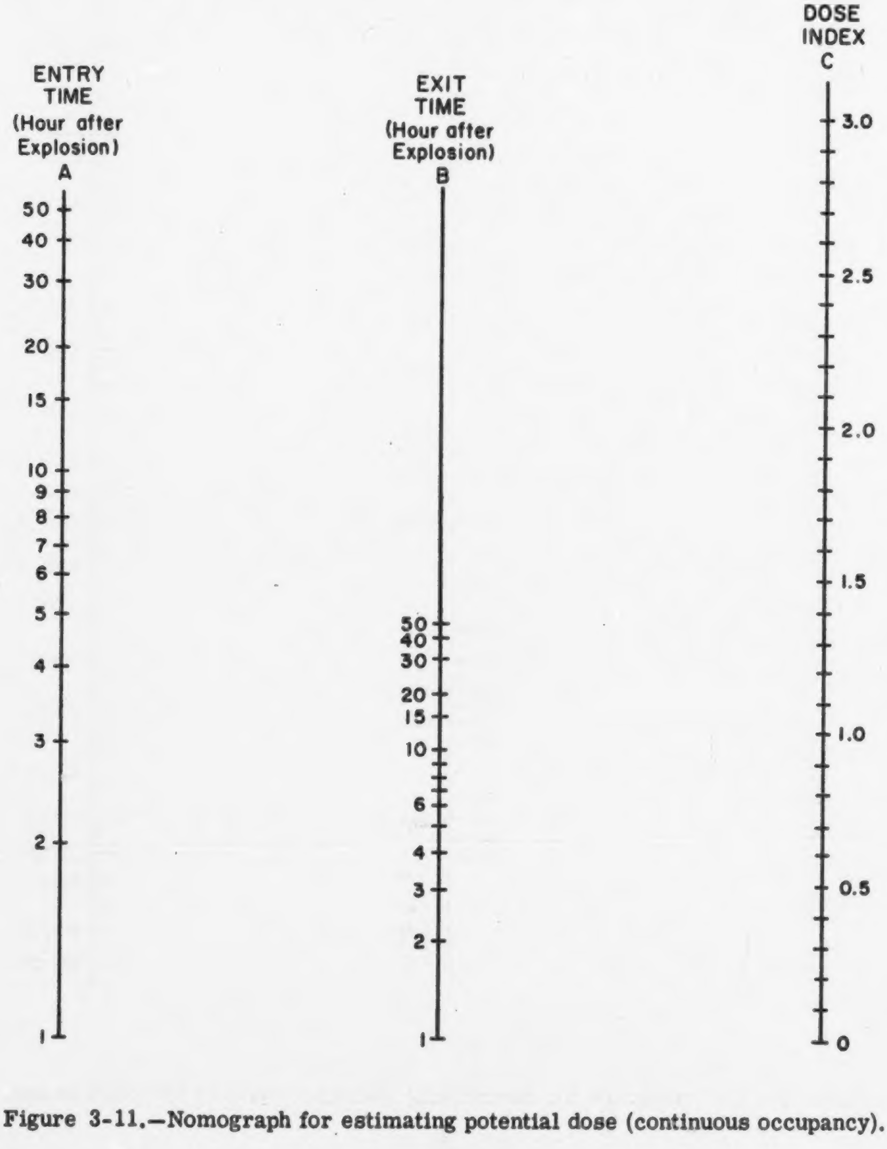
12.6

Figure 3-10.—Nomograph for determining radiation intensity for ships at sea.

53

and a standard intensity of 100 r/hr, first, determine the dose index by dividing the allowable dose by the standard intensity (dose index= $\frac{25}{100} = 0.25$). Next, place a straightedge on the nomograph in figure 3-11 so that it bisects all three scales (A, B, and C). With one end fixed on scale C at the value of 0.25, rotate the other end over scales A and B until the value on scale B exceeds the value on scale A by just 5 hours. Thus, entry time is indicated on scale A as 10 hours. This means that a waiting period of 10 hours is necessary before the area can be occupied continuously for a period of five hours without exceeding the allowable radiation dose.

A more accurate estimation of the potential dose that can be expected from a given schedule of operations is possible when the dose index is known. Given the entry time and exit time the dose index can be determined using the nomograph


ENTRY TIME (Hour after Explosion) A
50
40
30
20
15
10
9
8
7
6
5
4
3
2
1
EXIT TIME (Hour after Explosion) B
50
40
30
20
15
10
6
4
3
2
1
DOSE INDEX C
3.0
2.5
2.0
1.5
1.0
0.5
0

12.6

Figure 3-11.—Nomograph for estimating potential dose (continuous occupancy).

54

in figure 3-11. For an entry time of 10 hours and an exit time of 15 hours the dose index is found by placing a straightedge so that it bisects scale A at 10 hours, scale B at 15 hours, and intersects scale C. The dose index will be indicated by the value on scale C at the point of intersection (0.25). The potential dose is the product of the dose index and the standard intensity. Thus, with a dose index of 0.25 and standard intensity of 100 r/hr, the potential dose = 0.25 x 100 = 25 r.

Estimates of safe stay times for continuous occupancy periods through two days after the explosion can be determined using information from the nomograph in figure 3-11. When the entry time and the dose index are known, the exit time is determined from the nomograph. The safe stay time can then be found by subtracting the entry time from the exit time. Given a dose index of 0.5 and an entry time of 4 hours, the exit time of 8 hours is indicated on scale B when the straightedge bisects scales A and C at the given values. Thus, safe stay time = 8 - 4 = 4 hours.

The countermeasures employed during and following a biological and chemical attack are very similar to the countermeasures used for the explosion of a nuclear weapon. During the emergency phase, the principal countermeasure is protection of personnel using protective masks, clothing, and shielded areas. Following the attack, decontamination of contaminated areas, material, and personnel will be required. Personnel decontamination will be under the control and supervision of medical department personnel.

ENGINEERING CASUALTY CONTROL

Engineering casualty control includes both machinery and electrical casualty control and has as its mission the maintenance of engineering services in a state of maximum reliability under all conditions of operation. Under this mission, the primary objective is the maintenance of engineering services so that the ship is able to function effectively as a fighting unit without impairment to its mobility and offensive or defensive power. The secondary objective is the minimization of personnel casualties and secondary damage to vital machinery. Engineering casualty control involves the prevention, minimization, and correction of operational and battle casualties to the ship's machinery, electrical, and piping installations.

Efficient engineering casualty control is the result of sound equipment design, careful inspection, thorough plant maintenance, and effective personnel organization and training. The engineer officer is directly concerned with all but the first of these factors, and he is indirectly concerned with sound equipment design because it is partly the result of the equipment failure reports submitted by the ship.

The engineer officer must insist that his subordinates conduct frequent and careful inspections of all systems and machinery in order to discover any evidence of impending malfunctioning or failure. Unusual noises, excessive vibrations, abnormal pressures, abnormal temperatures, and abnormal operating speeds are all indications that immediate corrective action is imperative in order to prevent complete failure.

The ability to detect and identify signs of incipient trouble in equipment is developed through familiarization with plant operation. However, familiarity must not be allowed to substitute for investigation to establish fully the cause of an abnormal or unusual condition.

The engineer officer must ensure that thorough plant maintenance procedures are carried out. Conscientiously conducted tests and inspections which ascertain the true condition of equipment are invaluable aids to proper preventive and corrective maintenance of a plant. Such tests and inspections should be published in the engineering department Organization and Administration Manual. This manual should also provide for the effective organization and training of engineering personnel.

The first phase of handling any engineering casualty is concerned with minimization of the casualty. During this phase, measures must be taken to control the casualty to prevent further damage to the unit concerned and to prevent spread of the casualty through secondary effects. The second phase consists of restoring (insofar as practicable) the services which were interrupted as a result of the casualty. When no machinery damage or failure has occurred as a result of the casualty, this phase usually completes the operation. A third phase consists of making the repairs necessary to restore the installation to its original condition.

ENGINEERING CASUALTY CONTROL MANUAL

The engineering casualty control manual is a handbook of information and procedures for use by the engineering officer of the watch (EOOW) and engineering personnel in preventing and controlling casualties to the main propulsion plant. Its purpose is to establish normal and alternate methods of operating all the vital systems and to specify corrective action in connection with operational or battle casualties to these systems.

Each type commander prepares and issues a complete engineering casualty control manual. It is the responsibility of the engineer officer of each ship to alter the manual to fit the ship's engineering installations. The engineer officer is normally the custodian of the manual and is responsible for preparation of sufficient copies to have one available at the log room, main engine control station, electrical control station, major engineering operating stations, Repair 5 (or Repair 4 and 5), bridge and secondary conn, and damage control central. Upon detachment, the engineer officer should ascertain that all copies are accounted for and transfer custody to his relief. The engineer officer is responsible for making certain that each copy of the manual reflects the most recent alterations to the engineering plant.

The engineering casualty control manual contains brief (but complete) descriptions of the main propulsion machinery, main and auxiliary steam systems, main and auxiliary exhaust systems, main and auxiliary condensate and feed systems, main air ejectors, steam and fresh water drain systems, electric plant and power distribution system, compressed air systems, casualty power system, main and secondary drainage systems, firemain system, fuel oil and diesel oil transfer and service systems, lube oil systems, fresh water distribution system, atmospheric relief piping system, and ventilation system. Line diagrams showing the location of the components of these systems are also included to aid in understanding the various systems and facilitate locating valves and fittings.

A section of the manual is devoted to watch routine and machinery and system combinations for all operating conditions such as replenishment, maneuvering while entering or leaving port, flight quarters, general quarters, general emergency, steady steaming, man overboard, rescue and assistance at sea, full power run, lighting-off and securing the plant, lighting-off in an emergency, fire, operation for extended periods without ventilation, laying a smoke screen, operation in heavily mined waters, and handling steering casualties.

The most important section of the manual is the one containing standard procedures for handling engineering casualties. Every foreseeable casualty should be listed with complete, clear, and concise corrective action outlined in each case. Operational casualties should be separated from battle casualties and both further subdivided into main propulsion, auxiliary, and electrical sections. Manuals for ships with separate firerooms should have the main propulsion casualties further subdivided into fireroom and engineroom casualties.

Several publications are available on the ship which will afford considerable assistance to the engineer officer when altering the type commander's engineering casualty control manual and preparing the extra copies. These publications are NavShips Technical Manual, manufacturer's technical manuals, volumes 1, 2, 3, and 5 of the Ship Information Book, booklet of machinery plans, instruction manuals for sound powered telephones, NWIP-50-1(B), Battle Control (U), and FXP-3B (Ship Exercises—Battle Problems). On ships which do not have the Ship Information Book, the General Information Book and the Record of Electrical Installations and Electrically Operated Auxiliaries will supply the necessary information.

ENGINEERING CASUALTY CONTROL PLOT

An engineering casualty control plot should be maintained at main engine control and at secondary engine control stations (on ships so equipped), and at Repair 5. The plot must show all major machinery installed in the engineering spaces, the main shafting and line bearings, all main engines and boilers, the arrangement of major piping systems such as the main and auxiliary steam systems, the main and auxiliary condensate and fuel oil piping, the fire pumps and the firemain loop, the main drainage system, and the electrical plant. The plot must accurately reflect the operating condition of the engineering plant and show the machinery and systems in use. When properly maintained it affords a ready reference for the engineering officer of the watch.

CHAPTER 4

TRAINING

The principal objective of Navy training is to maintain a naval force in an optimum state of readiness for the defense of the United States. Navy training consists of fleet training, shipboard training, and naval school training. General policies for fleet training are stated in *Ship Exercises*, FXP-3-B, and (except for shakedown and refresher training) are discussed only briefly in this chapter. Shipboard training and naval school training, however, are discussed in considerable detail, especially as they pertain to the ship's engineering department. All three phases of Navy training are closely allied and contribute to the development of highly trained and fully qualified individuals who man the ships of our modern Navy.

FLEET TRAINING

Fleet training of ships is the responsibility of the Deputy Chief of Naval Operations for Fleet Operations and Readiness, and is controlled and supervised by the Commander in Chief, Atlantic Fleet, and the Commander in Chief, Pacific Fleet. The Fleet Commanders in Chief exercise their training responsibilities through their type commanders. This delegation of authority provides for battle readiness at every level of administrative command while assuring unity of purpose and uniformity of standards. Fleet type organization is illustrated in figure 4-1. The fleet training command (Commander, Training Command) of each fleet assists the other type commanders by supplying services for programs and conducting training programs (shakedown and refresher training) as directed by the fleet commanders.

The training cycle for each ship corresponds to the period between regularly scheduled shipyard overhauls. The most important feature of the training cycle is that it furnishes a basis for scheduling inspections and trials. The intratype competitive period corresponds to the fiscal year regardless of the training cycle. Fleet operating schedules are issued on both a quarterly and an annual basis, and govern many factors which must be taken into consideration in the planning of maintenance and training.

TYPE TRAINING EXERCISES

Type commanders prescribe the training exercises to be conducted by ships of the type during the intratype competitive period. The

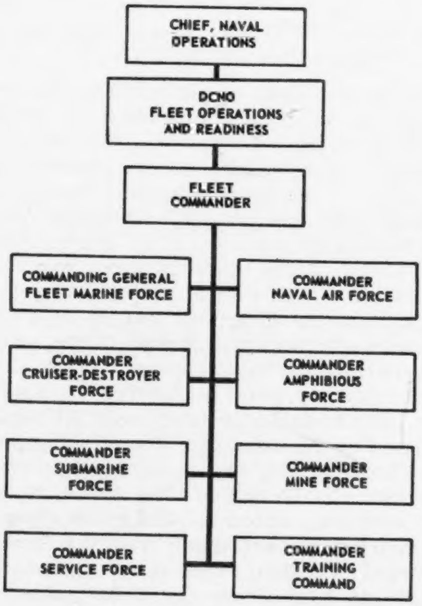

CHIEF, NAVAL OPERATIONS
DCNO FLEET OPERATIONS AND READINESS
FLEET COMMANDER
COMMANDING GENERAL FLEET MARINE FORCE
COMMANDER NAVAL AIR FORCE
COMMANDER CRUISER-DESTROYER FORCE
COMMANDER AMPHIBIOUS FORCE
COMMANDER SUBMARINE FORCE
COMMANDER MINE FORCE
COMMANDER SERVICE FORCE
COMMANDER TRAINING COMMAND

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Figure 4-1.—A fleet type organization.

tactical commander of ships in a task force requires that ships of the force perform, either separately or in company with other ships, the exercises required by the type commanders.

Each type commander is responsible, under the fleet commander, for the administration and control of the training program of each ship assigned to his administrative command. In the discharge of his training responsibilities, the type commander (1) designates the required exercises and establishes minimum exercise requirements, (2) reallocates ammunition allotted to him by the fleet commander, (3) selects exercises to meet specific training requirements, (4) divides ships into competitive groups, (5) provides for observation of certain exercises by qualified observers, (6) appraises the performance of each ship, and (7) evaluates and maintains records of the overall performance of each ship. When awarding a final grade for performance, the type commander has broad authority and may weigh separate exercises and other performances, at his own discretion, to allow realistic evaluation of the ship's organization, discipline, and opportunities for training. The type commander may delegate his authority for fleet training (except for policy guidance) to subordinate commanders of units operating outside his supervision and observation.

Maximum benefit is derived from any training exercise when the performance of the exercise is properly observed and analyzed. If the exercise is to be graded, formal observation is mandatory. When the importance of the exercise justifies such assignment, observers will be from outside the observed ship. The analysis of the exercise, in the form of a critique, is held as soon as practicable after the completion of the exercise to determine errors committed, deficiencies in material or procedures, and recommendations for improvement.

Exercise appraisal is based on the readiness of the ship to deal effectively with the situation simulated by the exercise. The effect of factors over which the ship has no control, however, is taken into consideration. The observing command submits a recommended grade along with the report of the exercises observed; however, the award of a final grade is the responsibility of the type commander (or a designated subordinate) and is aimed at establishing uniformity within the type. In the evaluation of readiness, consideration is given to the performance of basic exercises, the performance of prescribed exercises, and the handling of actual casualties which occur.

SHAKEDOWN AND REFRESHER TRAINING

After a ship has been commissioned and has completed fitting out, she undergoes shakedown training. A recently activated ship or a ship leaving a shipyard after a regular overhaul undergoes refresher training. The ship is put through an intensive combat readiness training period by a designated Fleet Training Group (FTG), under the direction of the Commander, Training Command, U. S. Atlantic or Pacific Fleet, as applicable.

During the refresher or shakedown training period operational control of the ship is with Commander, Training Command, and exercised by the Commander, Fleet Training Group.

Fleet Training Group

The primary function of a Fleet Training Group is to help ships train themselves. In implementation of this, training groups have been delegated authority to control the assignment of operating areas, to coordinate and regulate the conduct of training exercises, and to supply training services in their assigned operating areas.

A Fleet Training Group is generally divided into two sections—an administrative section and an afloat training section. The administrative section performs the work of scheduling the activities of ships undergoing training; it correlates such activities as target towing services, camera services, and dual ship exercises.

The afloat training section is organized into departments in the general pattern of shipboard organization. The engineering branch, however, is divided into two departments: engineering and damage control.

Arrival Inspection

Ships reporting for refresher training receive an arrival or training readiness evaluation inspection, and an operational readiness inspection (ORI) on the completion of training. Immediately following the final battle problem which, depending on type requirements, may be counted as an ORI, or part of an ORI, a critique is held to point out and discuss weaknesses noted by FTG personnel. In addition to conducting the engineering and damage control phases of these inspections the FTG engineering and damage control departments, respectively, conduct a first-day's ride (and additional rides as practicable) to conduct and observe drills, and instruct personnel of the ship in the proper techniques of damage control. The number of rides to be conducted are planned in advance and will depend upon the needs of the ship and the availability of FTG engineering and damage control instructors.

The purpose of the arrival inspection is to determine the organizational and material readiness of the ship to commence refresher training. The arrival inspection checkoff lists are based upon standards prescribed by Battle Control (U), NWIP 50-1(B), NavShips Technical Manual, and directives of the Fleet Commander and type commanders.

Immediately following the arrival inspection, a critique is held and a complete written report of the discrepancies noted is left with the executive officer of the ship. A formal report is submitted to the Commander, Training Command, with a copy to the type commander. Those deficiencies which affect refresher training should be corrected as soon as possible. As soon as discrepancies are corrected, FTG inspectors correct the discrepancy list. It is expected that all deficiencies will be corrected prior to ORI.

The arrival inspection of the engineering department is made by one or more officers of each of the FTG engineering and damage control departments, assisted by a group of FTG enlisted men. To facilitate conducting the inspection of the ship's engineering department, the engineer officer should:

1. Furnish at least two ship's personnel who are familiar with logs, records, and publications to assist the inspecting officer.
2. Have logs, records, and publications grouped in sequence, as indicated in instructions, to facilitate location and inspection.
3. Have one man who is familiar with the spaces, and the location of safety precautions and operating instructions, standing by each engineering space.
4. Have keys readily available for entering locked spaces.

The fleet training command usually forwards to each ship scheduled to undergo refresher or shakedown training arrival inspection or training readiness evaluation checklists and appropriate information and instructions concerning the conduct of training in the Fleet Training Group to which the ship has been assigned. The engineer officer should study the instructions carefully and check his department's organization and administrative procedures against the checklists. Obviously, if the engineer officer corrects most administrative discrepancies in his department before the ship reports to the Fleet Training Group, he will be able to devote more time to the administration of training and thereby enable his department to obtain greater benefit from the refresher or shakedown training period.

FTG Instruction

Engineering department and damage control department officers and enlisted shipboard instructors (shipriders) are assigned to each ship as the workload of the Fleet Training Group and ship's operations permit.

FTG shipboard instructors act as observers, instructors, advisors, and inspectors. In these capacities, they may offer constructive criticism or recommend improvements. At times they may assist with impromptu instruction, lectures, and demonstrations. Upon completion of each shipride, the senior engineering and the senior damage control shipboard instructors submit to the commanding officer of the ship, via the executive officer, written reports of the day's training. Copies of the reports are also submitted to the FTG engineer officer and FTG damage control officer.

During battle problems, FTG personnel are observers both by title and function. They impose damage by setting up, as realistically as possible, various exercises and then observing action taken by ship's personnel to combat the imposed damage. They do not operate any equipment, but will endeavor to stop an evolution that may result in damage to equipment or injury to personnel.

FTG shipboard instructors have observed many ships in training; they know which methods work and have picked up many pointers both in training techniques and administrative procedures. When conditions following the day's exercises permit, the instructors conduct a critique with the ship's personnel involved in the training. During the critique, the instructors call attention to errors observed during drills, make recommendations for improvement, and answer questions concerning the training.

Operational Readiness Inspection

The purpose of the operational readiness inspection is to evaluate the ability of the ship to perform her assigned mission. In addition to the final battle problem, ORI includes evaluation of the ability of the ship's Condition III Watch Organization to conduct a full power run, fight fires, rescue a man overboard, and render assistance to another ship. These drills and the full power run are usually conducted prior to the day of the final battle problem.

The final battle problem serves to familiarize the personnel of the ship with a full scale battle problem and the manner in which it is conducted. Insofar as practicable, the battle problem approximates wartime operations expected of the type ship involved.

During the battle problem, FTG engineering personnel observe and comment on the following:

1. Battle preparations, including battle dress, stowage of gear, missile hazards, safety hazards, fire hazards, readiness of all equipment, split plant operation, and setting of condition Zebra in engineering spaces.
2. Handling of hits including complete knowledge of plant by personnel, ability to recognize material casualties and remedy them with a minimum loss of time and power, replacement of key personnel, handling personnel casualties, firefighting techniques, investigation of spaces for damage, rigging of casualty power cables, use of emergency steering methods and equipment, time to cross-connect and split the engineering plant, observation of safety precautions, use of prescribed procedures, control of flooding and the performance of personnel at main control.
3. Gastight envelope in the engineering spaces including the time required to set and its effectiveness during a nuclear attack.
4. Communications, including phraseology, rapidity and accuracy of transmission, procedure, doctrine, clearing the circuit of casualties, rigging emergency communications, and circuit discipline.
5. Nuclear defense measures, including detection of radioactivity, testing of personnel suspected of exposure, relief provisions for exposed personnel, and methods used to limit contamination of interior of ship.

The FTG damage control personnel observe and comment on the following elements of the final battle problem:

1. Control of flooding.
2. NBC warfare defense.
3. Firefighting.
4. Steering casualty, including rigging of casualty power and emergency communications.
5. Battle repairs to hull and piping.
6. Personnel casualties.

SHIPBOARD TRAINING PROGRAM

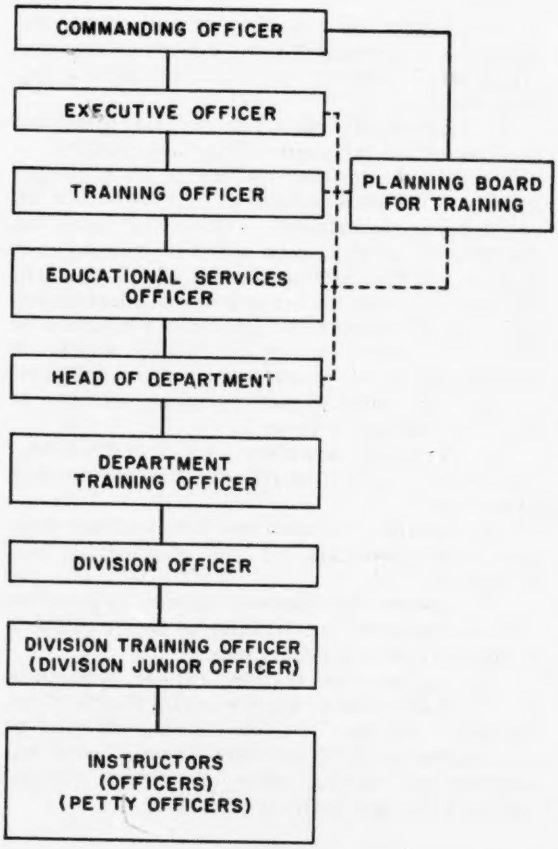
The shipboard training program must consider the organizational framework and operating schedules of the ship. The application phase of the training program involves the actual teaching of personnel and the evaluation of individual progress as well as the ability to function as a team. Analysis of the results of shipboard training entails (1) observation of team (group) and individual performance, (2) comparison of performance with standard criteria, and (3) recognition of methods for improvements. The effective shipboard training program has as its objective the development of optimum individual and team efficiency.

The basis of all training is the development of skills in the individual. The individual is trained to fill successfully his billet aboard ship and to prepare for advancement in rating and for acceptance of more responsibilities. Team training, or training of a ship as a whole, can only be accomplished with a successful individual training program as a base.

ORGANIZATION FOR TRAINING

The commanding officer heads the shipboard organization for training, as shown in figure 4-2. The organization is responsible for planning, coordinating, and conducting drills, classes, and instruction designed to increase the specialized and general professional knowledge of the personnel of the command. The organization is governed in its actions by the policies and plans of higher authority—principally those of the type commander.

Close attention must be given to the training potentialities of the individual ship, and to the elimination of all but essential paperwork in the program. Training methods will vary from ship to ship, depending on the size, design, and personnel allowance; and each ship's training time must be carefully balanced with the time allotted for maintenance. The proper time apportionment must be made by officers who know existing shipboard training and maintenance


COMMANDING OFFICER
EXECUTIVE OFFICER
TRAINING OFFICER
PLANNING BOARD FOR TRAINING
EDUCATIONAL SERVICES OFFICER
HEAD OF DEPARTMENT
DEPARTMENT TRAINING OFFICER
DIVISION OFFICER
DIVISION TRAINING OFFICER (DIVISION JUNIOR OFFICER)
INSTRUCTORS (OFFICERS) (PETTY OFFICERS)

114.28

Figure 4-2.—Shipboard organization for training.

conditions. Once a balance is established, programs for training and for maintenance should be carefully planned, executed, and controlled. The executive officer exercises overall supervision of the training program under the direction of the commanding officer.

Planning Board For Training

The ship's planning board for training is generally composed of the executive officer as chairman, the heads of departments, the training officer, and the educational services officer. The board performs the following general functions:

1. Advises and assists the commanding officer in the formulation of training policies.
2. Establishes the training program for the ship and periodically evaluates the training program by reviewing the schedules within the program.
3. Establishes a training syllabus for the training of junior officers and one for enlisted men.

The planning board meets periodically to evaluate progress, coordinate action, and propose changes to improve the training program and future requirements. The personal knowledge of members, the reports of the educational services officer, and the use of various control devices, all serve to indicate areas needing improvement. Often the source of difficulties and maladjustments in the training program can be pinpointed with accuracy and the responsibility fairly placed where it belongs—on individual officers, petty officers, untoward circumstances, or conflicting requirements of higher authority.

Regardless of the care exercised in the development of the original training program, the need for changes will occur often. The following items should be examined periodically for their possible effect on the training program:

1. Changes in the nature or schedule of the ship's operations.
2. Installation of new or improved equipment.
3. Changes in the qualifications for advancement in rating.
4. Changes in personnel assignments.
5. Changes in regulations or procedures under which the ship is operating.
6. Completion of any phase of the training program.
7. Increases or decreases in facilities or availability of fleet and bureau controlled training establishments.

Educational Services Officer

The educational services officer assists the executive officer in the administration of the training, information, and education programs of the ship. In large ships it may be possible to assign the duties of the educational services officer to an officer as primary duty. In smaller ships, the duties may be assigned an officer as collateral duty or the executive officer may elect to perform the duties himself. The educational services officer performs the following duties:

1. Supervises the administration and operation of the training office and of the ship's training aids.
2. Serves as a member of the ship's planning board for training.
3. Maintains contact with fleet and bureau controlled training activities and advises the planning board for training and other ship's personnel of the use of such facilities for training:
4. Secures quotas, as recommended by heads of departments, for personnel attending fleet or functional schools.
5. Assists examining boards by providing material and personnel as requested.
6. Schedules orientation and indoctrination courses for officer and enlisted personnel.
7. Directs the educational services program including the interviewing and counseling of personnel; processing of applications for officer, enlisted, and correspondence courses; administration of special and end-of-course tests; and assisting personnel in obtaining high school, college, business, and military education credits.
8. Processes applications and makes necessary interviews and tests for limited duty officer, Naval Academy Preparatory School, Officer Candidate School, and Naval Reserve Officer's Training Corps.
9. Prepares, maintains, and submits required training records and reports.

The educational services officer reports to the executive officer in the performance of his assigned duties. He collaborates with and advises department training officers and division training officers concerning the overall training program and the implementation of special training programs.

Engineering Training Officer

The engineering training officer is the training officer of the engineering department as appointed by the engineer officer. Generally, the duties of the engineering training officer are assigned as collateral duty to one of the assistants to the engineer officer. As the assistant to the engineer officer for the administration and coordination of the engineering training program, the engineering training officer performs the following duties:

1. Assists the engineer officer in the development of a department training program in support of the training objectives of the ship.
2. Assists the engineer officer in the development of a planned and coordinated training program to provide qualified reliefs for key personnel.
3. Implements approved training plans and policies within the engineering department.
4. Coordinates and assists in the administration of division training programs within the engineering department. (This duty includes supervision of the preparation of training materials and the review of curriculum, courses, and lesson plans; assistance in the selection and training of instructors; periodic evaluation of instruction given at drills, during watch, on station, and in the classroom; and procurement, through the educational services officer, of training aids and devices.)
5. Prepares, maintains, and submits training records and reports for the engineering department.
6. Initiates requisitions for training supplies and materials for the engineering department.
7. Assists the engineer officer in planning and coordinating the training of junior officers of the engineering department.

The engineering training officer reports to the engineer officer for the performance of his assigned duties. Division training officers of the engineering department consult with the engineering training officer for advice and assistance in their training programs.

Division Training Officer

The duties of the division training officer are generally assigned as collateral duty for the junior division officer or are performed by the division officer himself. As the assistant to the division officer for the administration and coordination of the division training program, the division training officer performs the following duties:

1. Plans, develops, and ensures the preparation of division training schedules, and obtains the training space and materials necessary to support the schedules.
2. Selects and trains instructors for the division.
3. Supervises the preparation of training material and reviews curriculums, courses, and lesson plans for the division.
4. Obtains, maintains custody of, and issues required training aids and devices.

5. Evaluates all instruction within the division.
6. Prepares, maintains, and submits training records and reports required of the division.
7. Initiates requisitions for training supplies and materials for the division.
8. Encourages division personnel to use available naval schools.
9. Encourages division personnel to further the advancement of their careers through use of Navy and USAFI correspondence courses.

The division training officer reports to the division officer for the performance of his assigned duties. He consults with the engineering training officer and the educational services officer, as appropriate, in training matters affecting the division. The instructors of the division report to the division training officer.

Instructors

Every officer and petty officer in the engineering department must take an active part in the training program, and each is expected to be a competent instructor. There is no better method for junior officers or petty officers to attain definite positions as leaders than by demonstrating ability as an instructor. Each instructor must be capable in his specialty and display a potential teaching ability that can be developed through training and experience.

The major portion of engineering instruction will be given by the petty officers of the engineering divisions and each should become an experienced instructor in order to do his part in the training program. There is a natural tendency to assign instructor duty to the man most qualified in the subject matter to be taught. Such a method of selecting instructors may provide a high quality of instruction but it tends to place the entire burden of instruction on a few of the senior petty officers and stifle the enthusiasm of the others. In order to further train engineering personnel in the necessary skills, instructors should be assigned from all rates, including that of fireman. This method of selecting instructors often produces surprisingly good results. In order to teach a subject, the instructor must be thoroughly familiar with it; and particularly for the lower rated man, this may entail considerable preliminary study that may increase his own knowledge as well as that of the group he will teach.

Provision should be made to provide formal training in instruction techniques. Class "C" training courses are provided at instructor training schools at San Diego, and Norfolk. The courses provide excellent instructor training and should be utilized whenever practicable. There are usually one or two graduates of the course in each ship and they can be used to train others in the techniques of instruction. Several copies of the Manual For Navy Instructors, NavPers 16103 (revised) should be available for use by the instructors in the ship.

The job of instructing is twofold. An instructor not only must pass on knowledge, but he must develop certain attitudes in the men he teaches. The most effective method of teaching these attitudes is by example. The instructor must possess and constantly display these attitudes if he is to be a good instructor.

Pride in the Navy is one of the major desirable attitudes the instructor must foster. To be proud of the Navy, a man must first be proud of his part in the Navy, and proud of those parts of it with which he comes in contact. The instructor, because he is in immediate contact with the man, is a symbol of the Navy. Everything that the instructor says and does should be calculated to foster pride in the Navy.

Respect for authority is another desirable attitude which the instructor must develop in his men. The instructor, because he represents authority, must be someone that his men can respect. In the matter of being correct in his relationships with his men, the instructor must be fair, firm, and friendly.

Many times in his career a sailor is called upon to exercise his ingenuity. In order to develop a willingness to exercise ingenuity, the instructor must (by example or otherwise) show the man what ingenuity is and then give him the technical knowledge with which to work. One way to do this is to encourage the man to discuss makeshift or substitute materials or methods which he might use to accomplish tasks he will encounter on the job.

Enthusiasm plays an important role in teaching. The instructor who approaches his job with pride and vigor will find that his class will respond in a like manner. No one can be enthusiastic about anything which he feels is not important and useful. The wise instructor will always show the value of the things he teaches. An enthusiastic approach by the instructor, helps to develop (1) the desire to advance professionally, (2) pride in doing any job well, and (3) pride in doing more than is expected.

TYPES OF TRAINING

Training is useful only if it fills a need. The major need of the engineering department is officers and enlisted men who can maintain and operate the department and the engineering plant with maximum efficiency at all times and under all circumstances. The training necessary to achieve this objective can be classified according to subject matter categories as indoctrination, military training, professional training, operational training, leadership training, and academic training.

Indoctrination

Each man (officer and enlisted) must be afforded a period of indoctrination upon being assigned to the engineering department in order to familiarize himself with the regulations, organization, and physical layout of the department. The duration and complexity of the indoctrination will depend upon the man's rank or rate, his prior service, and the training program of the ship.

For junior officers (LTJGs, with less than two years of commissioned or warrant service, and all ensigns) the shipboard indoctrination period may be of considerable length. The training program of some ships requires that junior officers of the unrestricted line (code 1100/1105) be assigned to each of the five basic departments in the ship for a brief period for orientation. This is especially desirable for the career officer because it gives him an excellent opportunity to become familiar with the principal functions of each department.

The engineer officer is responsible for the training of junior officers assigned to the engineering department. Some type commanders issue training courses designed to prepare junior officers for specific duties in the engineering department (as well as in other departments) of ships of the type. The tendency to keep a junior officer in the job he knows in order to achieve a smoothly working organization should be avoided. Limiting the experience level of the individual makes no allowance for personnel casualty losses and stifles initiative by prohibiting advancement to positions of greater responsibility and prestige.

The standardization of shipboard organizations practically eliminates the need for an extensive indoctrination program for the enlisted man reporting for duty with prior shipboard experience. Only a brief orientation period designed to acquaint the man with his new surroundings is necessary for the seasoned sailor.

For proper indoctrination in the field of marine engineering, it is desirable to give firemen (FA and FN, including designated strikers) reporting to the engineering department, an orientation course consisting of brief assignments in each engineering division before assigning them to divisions for duty. The course will enable them to better understand the organization of the department and the necessity for team cooperation and coordination. The following objectives should be included in the engineering indoctrination program for firemen:

1. Auxiliaries division:
    a. To acquaint the fireman with the principles involved in the distillation process of the ship's distilling plant and with the importance of conserving fresh water.
    b. To acquaint the fireman with the operating procedure of the distilling plant.
    c. To familiarize the fireman with the duties of the boat engineer and the safety precautions pertaining to the handling and operation of small boats.
    d. To acquaint the fireman with the principles involved in hydraulics systems.
    e. To acquaint the fireman with the operating procedure of the heating and air conditioning systems.
    f. To acquaint the fireman with the duties of the machine shop and boat engine repair shops.
2. Boilers division:
    a. To acquaint the fireman with fueling ship procedures, the principles of combustion, and the operating procedures of the ship's boilers and the fireroom auxiliaries.
    b. To familiarize the fireman with fireroom safety precautions.
    c. To acquaint the fireman with feed pumps, care of boiler feed water and feed water systems.
3. Electrical division:
    a. To acquaint the fireman with common indications of trouble in electrical equipment and the action to be taken when trouble occurs.
    b. To familiarize the fireman with electrical safety precautions, especially those pertaining to the use of portable electrical tools and equipment.
    c. To acquaint the fireman with the electrical switchboards and shifting the electrical load.

d. To acquaint the fireman with the I. C. equipment and sound-powered telephones.

e. To acquaint the fireman with the maintenance and repair of motors and generators.

4. Main engines division:

a. To acquaint the fireman with the operating procedures of the main engines and engineroom auxiliaries.

b. To familiarize the fireman with engineroom watchstanding procedures and machinery and engineroom safety precautions.

c. To acquaint the fireman with the maintenance and repair of main engines, reduction gears, turbogenerators, pumps, air ejectors, and piping systems.

5. Repair division:

a. To acquaint the fireman with the importance of the watertight integrity of the ship, the care of damage control equipment, the care and maintenance of firefighting equipment, and the location of repair lockers in the ship.

b. To acquaint the fireman with the duties and responsibilities of the pipe shop, the shipfitter shop, and the carpenter shop.

Military Training

The aim of the military training phase of the shipboard training program is to familiarize the crew with military customs and courtesies, naval discipline (U. S. Navy Regulations and General Orders), military justice (Uniform Code of Military Justice), obligations and responsibilities of citizenship, conduct ashore in foreign countries (include the Status of Forces Agreements), and related subjects. Certain of these subjects may be included in the indoctrination program. The fact that the more experienced naval man often needs to be reminded of certain rights, privileges, courtesies, customs, obligations, and responsibilities, however, must not be overlooked. Educational services officers in some ships with heavy operating schedules that preclude formal classroom instruction have published excerpts from the Uniform Code of Military Justice in the ship's plan of the day for the purpose of informing the crew of certain individual rights and responsibilities. Morning quarters can be useful as a period of instruction as well as for muster and inspection of the crew.

Professional Training

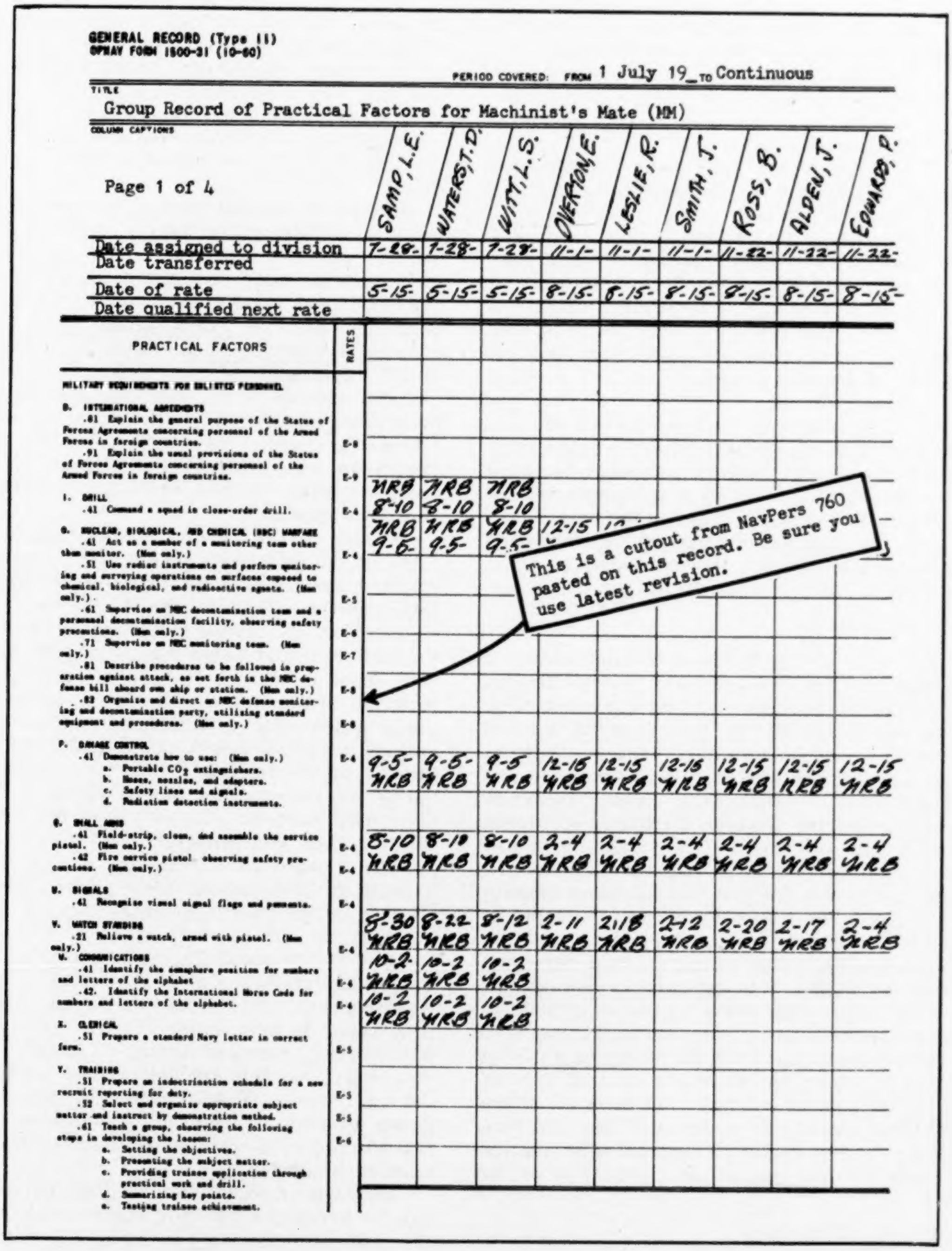
U. S. Navy Regulations require that junior officers keep a journal of their professional training. The journal may be maintained in a standard 3-ring binder and generally contains, among other things, a record of shipboard qualifications, completed assignments of the type commander training courses, completed correspondence courses, and such other training information as the commanding officer may direct.

The naval correspondence course program provides self-study training courses to assist officers of the U. S. Navy and Naval Reserve in improving their professional qualifications and broadening their general knowledge of naval science. The List of Training Manuals and Correspondence Courses, NavPers 10061 (revised), contains the procedure for ordering courses and the titles, NavPers numbers, and brief descriptions of the officer correspondence courses available. The engineer officer should encourage his officers to participate in self-study courses of the naval correspondence course program.

A large part of the division training program must be devoted to the professional training of enlisted personnel of the engineering divisions. Development of professional knowledge and physical skills increases the efficiency of the enlisted man and helps him to qualify for advancement in rating. The professional training program of the division must be based upon the qualifications for advancement in the various ratings assigned. One of the primary responsibilities of the division officer is to train personnel of the division in the duties to which they may succeed and to encourage them to improve their education and to advance in rating.

The division officer can keep informed of the rate of qualification progress of an individual by frequently observing how rapidly the man is learning the duties of his station. The Group Record of Practical Factors, shown in figure 4-3, is an excellent aid for recording qualification progress. This record and all other records illustrated in this chapter can be easily prepared using standard forms available in the Navy supply system and can be filed in standard 3-ring binders. Qualifications shown on the group records of practical factors should be transferred to the man's service record at least once each quarter.

Individual qualification in practical factors can be accomplished by training conducted on the job. On-the-job instruction is given by supervisory petty officers who provide the necessary manuals, publications, operating



GENERAL RECORD (Type II)
OPNAV FORM 1500-31 (10-60)

PERIOD COVERED: FROM 1 July 19_ TO Continuous

TITLE
Group Record of Practical Factors for Machinist's Mate (MM)

COLUMN CAPTIONS

Page 1 of 4

		SAMP, L.E.	WATERS, T.D.	WITT, L.S.	OVERTON, E.	LESLIE, R.	SMITH, J.	ROSS, B.	ALDEN, J.	EDWARDS, P.
Date assigned to division		7-28-	7-28-	7-28-	11-1-	11-1-	11-1-	11-22-	11-22-	11-22-
Date transferred										
Date of rate		5-15-	5-15-	5-15-	8-15-	8-15-	8-15-	8-15-	8-15-	8-15-
Date qualified next rate										
PRACTICAL FACTORS	RATES									
MILITARY REQUIREMENTS FOR ENLISTED PERSONNEL										
D. INTERNATIONAL AGREEMENTS .81 Explain the general purpose of the Status of Forces Agreements concerning personnel of the Armed Forces in foreign countries.	E-8									
.91 Explain the usual provisions of the Status of Forces Agreements concerning personnel of the Armed Forces in foreign countries.	E-9									
I. DRILL .41 Command a squad in close-order drill.	E-4	HRB 8-10	HRB 8-10	HRB 8-10						
G. NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) WARFARE .41 Act as a member of a monitoring team other than monitor. (Men only.)	E-4	HRB 9-5-	HRB 9-5-	HRB 9-5-	12-15	12-				
.51 Use radiac instruments and perform monitoring and surveying operations on surfaces exposed to chemical, biological, and radioactive agents. (Men only.)	E-5									
.61 Supervise an NBC decontamination team and a personnel decontamination facility, observing safety precautions. (Men only.)	E-6									
.71 Supervise an NBC monitoring team. (Men only.)	E-7									
.81 Describe procedures to be followed in preparation against attack, as set forth in the NBC defense bill aboard own ship or station. (Men only.)	E-8									
.82 Organize and direct an NBC defense monitoring and decontamination party, utilizing standard equipment and procedures. (Men only.)	E-8									
F. DAMAGE CONTROL .41 Demonstrate how to use: (Men only.) a. Portable CO_2 extinguishers. b. Hoses, nozzles, and adapters. c. Safety lines and signals. d. Radiation detection instruments.	E-4	9-5- HRB	9-5- HRB	9-5 HRB	12-15 HRB	12-15 HRB	12-15 HRB	12-15 HRB	12-15 HRB	12-15 HRB
Q. SMALL ARMS .41 Field-strip, clean, and assemble the service pistol. (Men only.)	E-4	8-10 HRB	8-10 HRB	8-10 HRB	2-4 HRB	2-4 HRB	2-4 HRB	2-4 HRB	2-4 HRB	2-4 HRB
.42 Fire service pistol observing safety precautions. (Men only.)	E-4									
U. SIGNALS .41 Recognize visual signal flags and pennants.	E-4									
V. WATCH STANDING .21 Relieve a watch, armed with pistol. (Men only.)	E-4	8-30 HRB	8-22 HRB	8-12 HRB	2-11 HRB	2-18 HRB	2-12 HRB	2-20 HRB	2-17 HRB	2-4 HRB
W. COMMUNICATIONS .41 Identify the semaphore position for numbers and letters of the alphabet	E-4	10-2- HRB	10-2 HRB	10-2 HRB						
.42. Identify the International Morse Code for numbers and letters of the alphabet.	E-4	10-2 HRB	10-2 HRB	10-2 HRB						
X. CLERICAL .51 Prepare a standard Navy letter in correct form.	E-5									
Y. TRAINING .51 Prepare an indoctrination schedule for a new recruit reporting for duty.	E-5									
.52 Select and organize appropriate subject matter and instruct by demonstration method.	E-5									
.61 Teach a group, observing the following steps in developing the lesson: a. Setting the objectives. b. Presenting the subject matter. c. Providing trainee application through practical work and drill. d. Summarizing key points. e. Testing trainee achievement.	E-6									

This is a cutout from NavPers 760 pasted on this record. Be sure you use latest revision.

24.3

Figure 4-3.—A sample group record of practical factors.

instructions, safety precautions, and manufacturer's technical manuals, and who keep their men busy in productive study whenever the opportunity arises.

To conduct training on the job, the instructor should (1) let his men study the necessary instructions concerning the job to be performed and then quiz them to determine if they have understood what they have read, explaining any misunderstanding that may have arisen; (2) perform the job accurately and carefully himself, explaining fully the actions which might not be observed otherwise; (3) repeat the performance of the job and let the men tell the instructor what to do, how to do it, and the key points involved; (4) let each man tell what he is going to do, how he is going to do it, and then do the step; and finally (5) let each man practice under the supervision of the instructor. This is an excellent method of teaching a complex skill to a few men. Proven methods of on-the-job instruction for various skills and groups of men are fully explained in the Manual for Navy Instructors, NavPers 16103 (revised).

The naval correspondence course program also provides self-study courses for the use of enlisted personnel in meeting requirements for advancement in rating. BuPers Instruction P1430.7 (revised) establishes mandatory requirements for advancement in rating which include the satisfactory completion of specified Navy Training Courses. Training Publications for Advancement in Rating, NavPers 10052 (revised), contains a bibliography of mandatory Navy training courses and recommended reading material for the various ratings. The mandatory Navy Training Course(s) for each rate is indicated by an asterisk (*). Each mandatory training course may be completed by successful completion of the correspondence course based on the mandatory training course. The List of Training Manuals and Correspondence Courses, NavPers 10061 (revised), is distributed to all ships to inform them of the latest available enlisted (as well as officer) training manuals and courses. A Record of Courses for Advancement in Rating, similar to the one shown in figure 4-4, will assist the division officer in determining (1) the status of self-study training in the division and (2) the personnel qualified for recommendation for advancement in rating.

Personnel should be recommended for advancement in rating only if and when they are in all respects fully qualified to hold the higher rate. Advancements should not be made in the nature of rewards for faithful or extended service or simply because the minimum service requirements have been fulfilled. It is poor policy to advance a person (or to recommend a person for a change in rating) to a position for which he is not fully qualified.

Over the years, the Navy has endeavored to be selective in accepting personnel for enlistment and the vast majority of enlisted personnel should be competent in the performance of their duties. The average Navy enlisted man is one whom any commanding officer would welcome. To make the enlisted performance evaluation system successful, it is desirable to assume that each command has an average crew. The proportion of individuals who exceed or fall below the average in performance, then would be about the same for all commands. For the overall good of the Navy and in the interest of the great majority of enlisted personnel, evaluations under the enlisted performance evaluation system should be related in general to the average crew concept.

One of the primary purposes of the evaluation system is to permit the commanding officer to influence positively the advancement opportunities of the individuals of his command. To make the performance factor in the final multiple for advancement effective, evaluations must differentiate between individuals so that credit is given according to demonstrated performance. Should all individuals be evaluated too highly, the ability to assist those individuals who are in fact outstanding will be reduced.

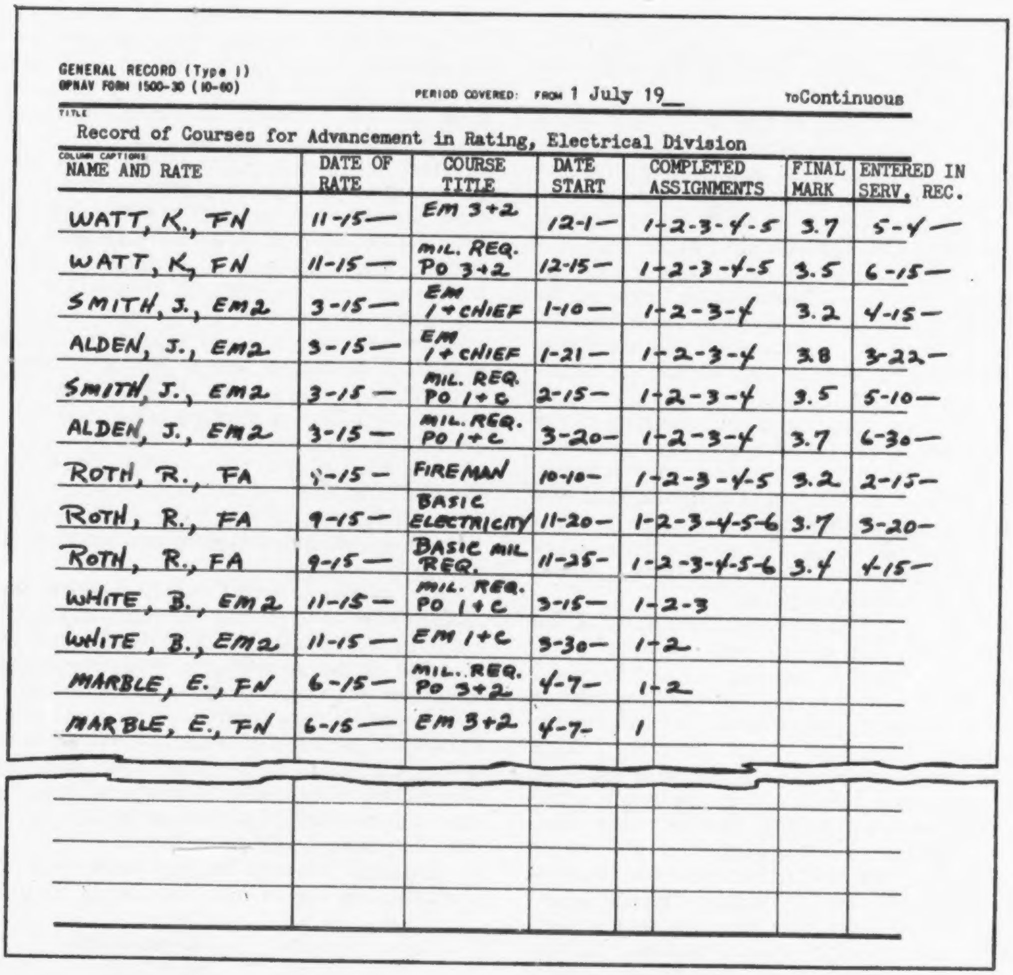
Enlisted evaluations are submitted semiannually, on the 16th of the month as follows:

E1-3	March/Sept
E-4	Apr/Oct
E-5	May/Nov
E-6	Jun/Dec
E-7	Jun
E8/9	Feb

The form used is NavPers Form 792 (Rev 6-65). These reports are designed to provide specific factual information for use in selecting the best qualified individuals for commissions.

The form used for special programs (application for warrant officer) is the Enlisted Performance Evaluation Report Form, NavPers 1339.

It is of the utmost importance that enlisted evaluation reports be completely frank. It is necessary that outstanding performance be



GENERAL RECORD (Type I)
OPNAV FORM 1500-30 (10-60)

PERIOD COVERED: FROM 1 July 19__ TO Continuous

TITLE
Record of Courses for Advancement in Rating, Electrical Division

COLUMN CAPTIONS

NAME AND RATE	DATE OF RATE	COURSE TITLE	DATE START	COMPLETED ASSIGNMENTS	FINAL MARK	ENTERED IN SERV. REC.
WATT, K., FN	11-15—	EM 3+2	12-1—	1-2-3-4-5	3.7	5-4—
WATT, K., FN	11-15—	MIL. REQ. PO 3+2	12-15—	1-2-3-4-5	3.5	6-15—
SMITH, J., EM2	3-15—	EM 1+CHIEF	1-10—	1-2-3-4	3.2	4-15—
ALDEN, J., EM2	3-15—	EM 1+CHIEF	1-21—	1-2-3-4	3.8	3-22—
SMITH, J., EM2	3-15—	MIL. REQ. PO 1+C	2-15—	1-2-3-4	3.5	5-10—
ALDEN, J., EM2	3-15—	MIL. REQ. PO 1+C	3-20—	1-2-3-4	3.7	6-30—
ROTH, R., FA	8-15—	FIREMAN	10-10—	1-2-3-4-5	3.2	2-15—
ROTH, R., FA	9-15—	BASIC ELECTRICITY	11-20—	1-2-3-4-5-6	3.7	3-20—
ROTH, R., FA	9-15—	BASIC MIL REQ.	11-25—	1-2-3-4-5-6	3.4	4-15—
WHITE, B., EM2	11-15—	MIL. REQ. PO 1+C	3-15—	1-2-3		
WHITE, B., EM2	11-15—	EM 1+C	3-30—	1-2		
MARBLE, E., FN	6-15—	MIL. REQ. PO 3+2	4-7—	1-2		
MARBLE, E., FN	6-15—	EM 3+2	4-7—	1		

24.1

Figure 4-4.—A sample record of courses for advancement in rating.

reported, and it is equally necessary that evaluations be thoroughly objective in reporting an individual's shortcomings. Knowledge of such shortcomings can be vital in the selection of personnel for duty assignment. A detailed discussion of the enlisted evaluation system is contained in the Bureau of Naval Personnel Manual.

Servicewide examinations for advancement in rating are conducted on a semiannual basis for pay grades E-4 through E-7, and annually for pay grades E-8 through E-9. These examinations are prepared by senior petty officers in each rating at the Naval Examining Center, Great Lakes, Illinois. The examination for advancement in a rating is based on the military and professional requirements of the rate and rating involved.

Operational Training

Operational training in the engineering department is closely allied with professional training and may be defined as the application phase of professional training. Operational training is received primarily through investigation, demonstration, and drill while manning watch (or battle) stations. Such training is useful when it: (1) developes individual and team efficiency, (2) familiarizes all personnel with minimum operational requirements in the ship, and (3) qualifies replacements for personnel losses.

On-the-job training and drills provide the best means of developing individual and team efficiency. Drills are more effective when they are held frequently and when all participants are kept occupied during the whole drill. It is very exasperating to be called away from routine duties to attend a drill in which nothing apparent is done. Each drill should be planned as carefully as any other method of instruction. The purpose of all drills is to give practice in previously learned skills. It is poor training practice to give instruction at the same time that performance is expected. The necessary instruction must precede the drill. The following procedure is recommended for this phase of operational training, and is especially applicable to engineering casualty control training:

1. Analyze the duties of each man in the team.
2. Instruct the individual(s) in the manner described in the preceding section on professional training on the job.
3. Permit the team (or individual) to perform a rehearsal or "dry run" of the operation slowly and without pressure.
4. Drill for greater speed and accuracy. Emphasize correct precedures in early drills and increase emphasis on speed as drills progress.
5. Allow the team (or individual) to perform the actual operation.
6. Evaluate the performance. Hold a critique to point out the errors observed and make recommendations to improve performance. Dispense praise judiciously and do not fail to correct errors in performance.

Operational training intended to familiarize personnel with minimum operational requirements in the ship may be conducted. In this type of training, personnel are trained in duties not generally regarded as being within the scope of their rate or rating. Training for an individual may include qualification in the duties of a helmsman as well as qualification in the duties of throttleman. Familiarization with the minimum operating requirements of the ship by all hands is necessary in small ships. Such training may have to be limited to familiarization with the minimum operating requirements of the department in large ships because of the number of people involved.

The qualification of replacements for personnel losses resulting from transfers or casualties is accomplished by carefully instructing personnel in their specific duties and in the duties of all other persons in the division or on a watch station. When a man is fully qualified in the duties of his job, he should be rotated through other jobs to which he may succeed within the division. Rotation of personnel for the purpose of training them is also required for watch stations. The Group Record of Practical Factors in figure 4-3 indicates the progress of men in qualifying for jobs within the division. An Individual Drill Record such as the one illustrated in figure 4-5, may be maintained at each watch station to indicate the state of training of watch personnel.

Leadership Training

Leadership training is necessary for every officer, petty officer, and potential petty officer in the ship in order to enable them to perform the principal function of a leader—to get the job done through people. Formal lectures provide an excellent method of presenting the principles and techniques of administration and supervision essential to effective leadership. The following items represent the minimum requirements of the efficient supervisor.

1. He must be familiar with the job he is to supervise and possess a reasonable amount of skill in the performance of that job.
2. He must know military policy well enough to administer that policy.
3. He must know how to handle men in such a way as to obtain maximum productive effort.
4. He must know job methods well enough to ensure the efficient progress of work through proper arrangement of the shop or work area, proper assignment of men to jobs, and the employment of safe work practices.
5. He must know how to select and use proper methods of instruction.
6. He must be able to develop in men the desire to further their career opportunities through self-study and improvement.

Effective leadership must be developed in men. Leadership training is always in demand because progress is constantly being made in the development of more modern and efficient job methods and techniques of personnel management. A variety of training aids are available and some type commanders have established schools to assist and augment the shipboard leadership training program.

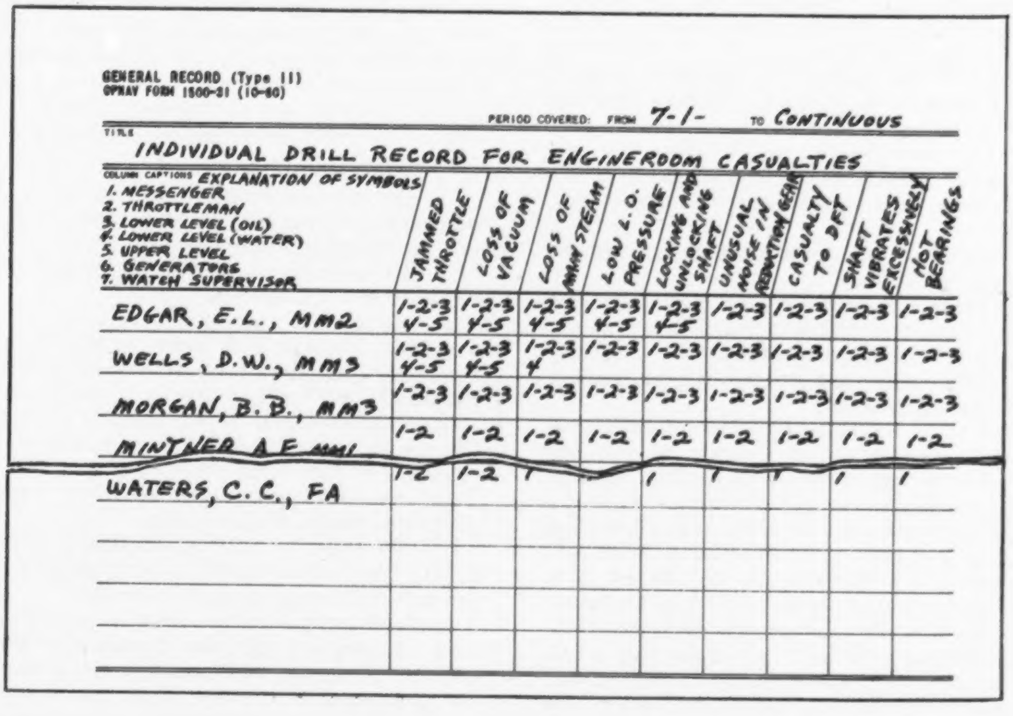
Academic Training

Correspondence courses of the U. S. Armed Forces Institute (USAFI) are available for furthering the academic training of individuals in the ship. The USAFI Catalog, NavPers 15857 (revised), contains a list of the self-study courses available and includes eligibility requirements for the various courses. The ship's educational services officer should be familiar with the details concerning the USAFI courses available and the methods for obtaining high school and college credits for successful completion of the courses. The publication Correspondence Courses Offered by Colleges and Universities Through the U. S. Armed Forces Institute, NavPers 15819, lists the correspondence courses available from institutions of higher learning participating in the education program of the U. S. Armed Forces Institute.

TRAINING RECORDS

The work of preparing training schedules and maintaining training records should be decentralized in order that no one officer or petty officer is given an unreasonable burden. The scheduling of shipboard training requires the careful attention of the training officer, heads of departments, and division officers in order to minimize conflict with other ship activities and to ensure that the time allotted for training is used to the best advantage.

The only justification for a training record is that it indicates to the officers responsible for training (1) how much has been accomplished, and (2) how much remains to be accomplished. It should be emphasized that records must be kept to an absolute minimum consistent with needs. The true measurement of an effective training program is performance, and the basic objective of any record system is to assist in accomplishing this in the simplest way possible. The record of unit training accomplished does



GENERAL RECORD (Type II)
OPNAV FORM 1500-31 (10-60)

PERIOD COVERED: FROM 7-1- TO CONTINUOUS

TITLE
INDIVIDUAL DRILL RECORD FOR ENGINEROOM CASUALTIES

COLUMN CAPTIONS EXPLANATION OF SYMBOLS 1. MESSENGER 2. THROTTLEMAN 3. LOWER LEVEL (OIL) 4. LOWER LEVEL (WATER) 5. UPPER LEVEL 6. GENERATORS 7. WATCH SUPERVISOR	JAMMED THROTTLE	LOSS OF VACUUM	LOSS OF MAIN STEAM	LOW L.O. PRESSURE	LOCKING AND UNLOCKING SHAFT	UNUSUAL NOISE IN REDUCTION GEAR	CASUALTY TO DFT	SHAFT VIBRATES EXCESSIVELY	HOT BEARINGS
EDGAR, E.L., MM2	1-2-3 4-5	1-2-3 4-5	1-2-3 4-5	1-2-3 4-5	1-2-3 4-5	1-2-3	1-2-3	1-2-3	1-2-3
WELLS, D.W., MM3	1-2-3 4-5	1-2-3 4-5	1-2-3 4	1-2-3	1-2-3	1-2-3	1-2-3	1-2-3	1-2-3
MORGAN, B.B., MM3	1-2-3	1-2-3	1-2-3	1-2-3	1-2-3	1-2-3	1-2-3	1-2-3	1-2-3
MINTNER A E MM1	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2
WATERS, C. C., FA	1-2	1-2	1		1	1	1	1	1

24.3

Figure 4-5.—A sample individual drill record for engineroom personnel.

not present a problem, but records of individual training are more complex and require more time to maintain.

When possible, the same forms used to schedule planned training should be employed to record completed training. The standard system described below has been developed to provide complete and satisfactory records which can be maintained with a minimum expenditure of time. If used, these schedules and records should facilitate orderly administration, careful planning, and effective control. Other benefits to be realized from the system are as follows:

1. Standardization of training records will simplify reliefs and turnovers of responsibilities, since all personnel will be familiar with the system.

2. Simplification and standardization of scheduling and recording will permit more accurate comparisons of training.

3. The scheduling procedures should result in improved cooperation and coordination of all personnel concerned. The source of difficulties and maladjustments in training programs can be pinpointed with accuracy and the responsibility placed where it belongs.

4. The decentralization of responsibilities for enlisted practical factor qualification will permit chief and leading petty officers to participate fully in the training effort.

5. The supplementary practical factor qualification records will strengthen and improve routine administration.

6. The coordinated planning of operation, maintenance, general administration, and training achieved by means of the quarterly forecasts will open new possibilities for constructive achievement.

Records of shipboard training may be prepared and maintained on four standard forms which have been designed to provide a maximum amount of flexibility. The four forms are identified as (1) the General Record (Type I), OpNav Form 1500-30; (2) the General Record (Type II), OpNav Form 1500-31; (3) the General Record (Type III), OpNav Form 1500-32; and (4) the Weekly Training Schedule, OpNav Form 3500-21.

Types I, II, and III are punched for easy filing in standard three-ring binders. Types I and II are properly spaced for fill-in by typewriter. Additional vertical lines must be drawn in on some of the forms to adapt them to various requirements. Most entries needed to prepare the weekly training schedule are printed on the form.

Types I and II should be conserved. Work sheets can be manufactured by trimming the margins from these forms and using the trimmed sections as templates to draw lines on a mimeographed or ditto stencil. Large ships which circulate 50 to 100 copies of their weekly schedule can follow the same procedure with OpNav Form 3500-21 because this form is designed for exact duplication on a standard typewriter. Mimeographed reproductions should be used for all transient records.

The forms may also be of value for many record keeping operations for which standardized forms are not available. For example, a daily publication inventory covering an entire year can be kept on one Type III form by using the calendar side to record accomplishment of the daily inventory and the reverse side to list the publications to be inventoried. The Type I form is also convenient for recording both the requirements for visual air tests of compartments and the results of such tests.

Training schedules and records which may be maintained by individual ships are mentioned in this section. The specific records to be maintained will be as prescribed by the type commanders or individual commanding officers. Detailed instructions for preparing each record are given in Shipboard Procedures, NWP 50(A).

The training officer normally will prepare and maintain six training schedules: (1) the Long-Range Training Schedule, (2) the Quarterly Training Plan, (3) the Competitive Exercises, Trials, and Inspections, (4) the Weekly Training Schedule, (5) the Office Assignments, Qualifications, and Courses, and (6) the Naval Leadership Training Schedule. The training requirements set forth by the type commander are a primary consideration of the planning board in establishing these training schedules.

The department head normally will prepare and maintain the Departmental Quarterly Training Schedule. The division officer normally will prepare and maintain such of the following records as are applicable to his division: (1) the Division Drill Schedule, (2) the Division Instruction Periods, (3) the Division Competitive Exercises, Trials, and Inspections, (4) the Courses for Advancement in Rating, (5) the Off-Ship School Training Schedule, and (6) the Individual Record of Off-Ship School Training.

The chief or other leading petty officer of each rating in each division, under the supervision of his division officer, should prepare and maintain the following records: (1) Group

Record of Practical Factors, (2) Self-Study Documents for Qualification, (3) Supplementary Record of Equipment Qualifications, (4) Individual Record of Basic Training, and (5) Individual Drill Record (prepared only when directed by the division officer).

The discussion which follows covers the long-range training schedule, the quarterly training plan, the weekly training schedule, and the engineering training records. Additional information concerning other records can be obtained from Shipboard Procedures, NWP 50(A).

Long-Range Training Schedule

The Long-Range Training Schedule is an important training record aboard ship. When properly used, it is the basic instrument for making and recording the plans for all training, and for keeping ship's personnel informed of projected training aims and operating schedules. In general, this schedule should contain enough information to guarantee that the overall coordination and planning of the shipboard training effort will be effective. It should provide the framework for the preparation of the quarterly training plan and for the weekly training schedule which contains more detailed information. For purposes of clarity and easy comprehension, the long-range schedule should be kept free of minor details which might obscure its broad outlines.

Initially, the long-range training schedule is prepared on Type I form at the beginning of a ship's regular overhaul period, and covers the entire training cycle. Each page covers one-quarter of the fiscal year. Therefore, the complete master schedule consists of approximately eight pages, or four sheets, of the Type I form and covers a period of approximately two years.

It should be noted that entries are the same as those which will subsequently appear on the first eight lines of the weekly training schedule. This arrangement should ensure a smooth integration of these two schedules. The main preparation considerations are (1) training during overhaul, (2) coordinating training and maintenance, and (3) weather considerations.

For most ships, the overhaul period provides the best opportunity for sending personnel to fleet, type, and service schools. Shipyard overhaul periods, also treated as leave periods, are characterized by heavy work loads of repairs, tests, fire watches, and supervision and inspection of shipyard work. Therefore, it is practically impossible to accomplish any large amount of organized training. Informal on-the-job training, shore-based schools, in-port fire drills, self-study courses, and drills by ratings should be pursued.

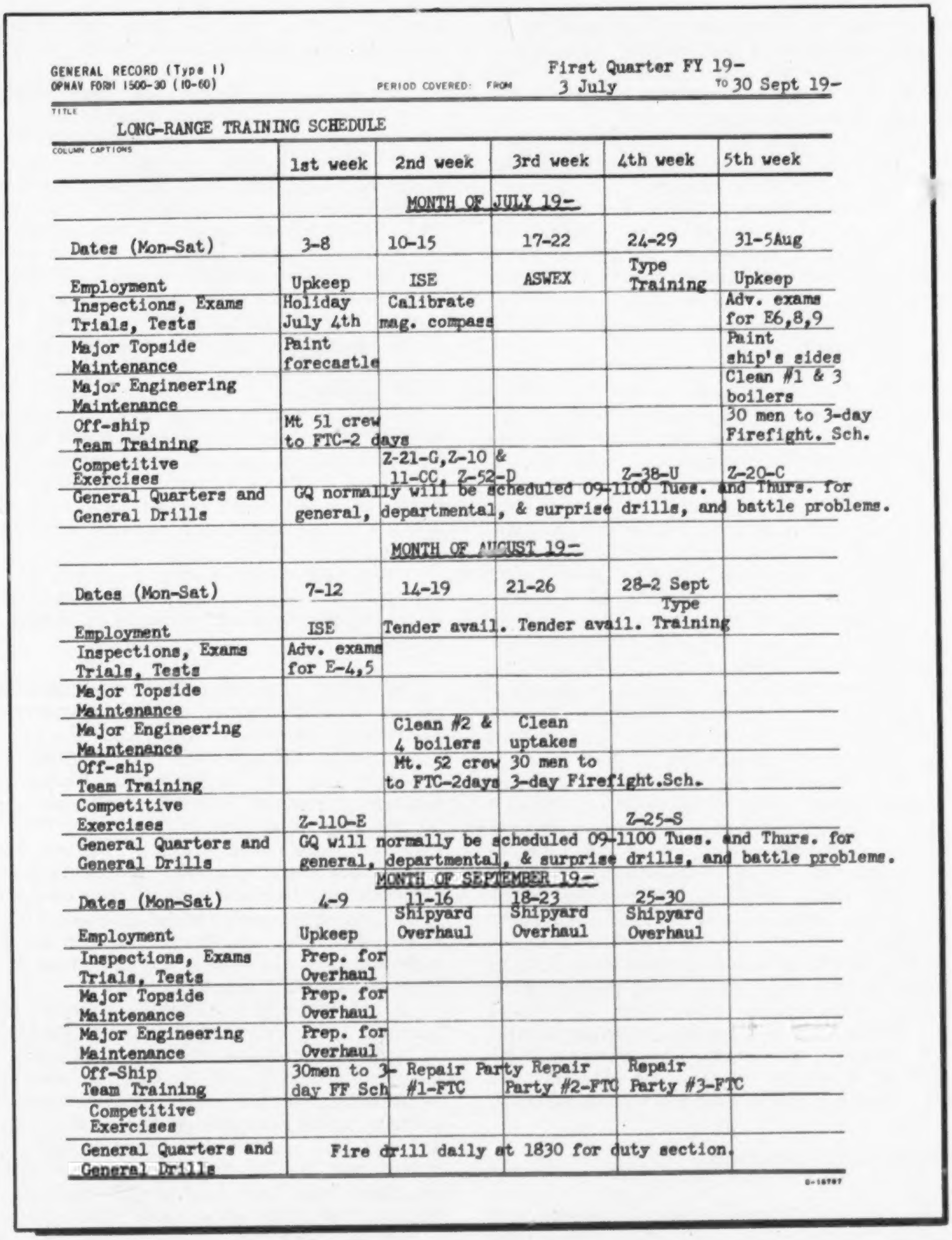
The available work hours must be allotted in accordance with the requirements for maintenance and training. Accordingly, the plans for accomplishing major maintenance, repairs, tests, and calibrations should be shown. Training plans, from the beginning of the preparation stage, should be realistically coordinated with plans for upkeep and maintenance to avoid formulation of ambitious and unworkable schedules.

Winter weather seriously handicaps both maintenance and training in certain operating areas. For ships in such areas, schedules for the second and third quarters of the fiscal year should show a concentration on below-decks maintenance, competitive exercises not requiring services, on-the-job training and self-study, and instruction periods. Schedules for the first and fourth quarters should emphasize underway team training, competitive exercises that require services, and topside maintenance. The overall readiness of the ship will be served best by avoiding the scheduling of underway training exercises during periods of winter gales and high seas.

Upon receipt of the quarterly operating schedules from the fleet or type commander, the training schedule is revised to reflect all significant changes in the previously planned employment of the ship. Unit commanders, who act as scheduling officers, should have their operations officer meet with the training officers of their ships before the start of each quarter to coordinate long-range planning. Copies of the current quarterly training schedule should be posted on the crew's bulletin boards for general information and guidance of all hands. Figure 4-6 illustrates a typical page of a long-range training schedule, prepared on OpNav Form 1500-30.

Quarterly Training Plan

If a ship's employment schedules are reasonably firm, the Quarterly Training Plan can be initially made out three or four weeks in advance of a given quarter, with greater detail added as the schedule finalizes. The purpose of this plan is to set forth in significant detail the objectives of the ship's training for a given quarter as based upon the long-range schedule.



GENERAL RECORD (Type I)
OPNAV FORM 1500-30 (10-60)

PERIOD COVERED: FROM First Quarter FY 19- 3 July TO 30 Sept 19-

TITLE
LONG-RANGE TRAINING SCHEDULE

COLUMN CAPTIONS	1st week	2nd week	3rd week	4th week	5th week
		MONTH OF JULY 19-			
Dates (Mon-Sat)	3-8	10-15	17-22	24-29	31-5Aug
Employment	Upkeep	ISE	ASWEX	Type Training	Upkeep
Inspections, Exams Trials, Tests	Holiday July 4th	Calibrate mag. compass			Adv. exams for E6,8,9
Major Topside Maintenance	Paint forecastle				Paint ship's sides
Major Engineering Maintenance					Clean #1 & 3 boilers
Off-ship Team Training	Mt 51 crew to FTC-2 days				30 men to 3-day Firefight. Sch.
Competitive Exercises		Z-21-G,Z-10 & 11-CC, Z-52-D		Z-38-U	Z-20-C
General Quarters and General Drills	GQ normally will be scheduled 09-1100 Tues. and Thurs. for general, departmental, & surprise drills, and battle problems.				
		MONTH OF AUGUST 19-			
Dates (Mon-Sat)	7-12	14-19	21-26	28-2 Sept	
Employment	ISE	Tender avail.	Tender avail.	Type Training	
Inspections, Exams Trials, Tests	Adv. exams for E-4,5				
Major Topside Maintenance					
Major Engineering Maintenance		Clean #2 & 4 boilers	Clean uptakes		
Off-ship Team Training		Mt. 52 crew to FTC-2days	30 men to 3-day Firefight.Sch.		
Competitive Exercises	Z-110-E			Z-25-S	
General Quarters and General Drills	GQ will normally be scheduled 09-1100 Tues. and Thurs. for general, departmental, & surprise drills, and battle problems.				
		MONTH OF SEPTEMBER 19-			
Dates (Mon-Sat)	4-9	11-16	18-23	25-30	
Employment	Upkeep	Shipyard Overhaul	Shipyard Overhaul	Shipyard Overhaul	
Inspections, Exams Trials, Tests	Prep. for Overhaul				
Major Topside Maintenance	Prep. for Overhaul				
Major Engineering Maintenance	Prep. for Overhaul				
Off-Ship Team Training	30men to 3-day FF Sch	Repair Party #1-FTC	Repair Party #2-FTC	Repair Party #3-FTC	
Competitive Exercises					
General Quarters and General Drills	Fire drill daily at 1830 for duty section.				

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24.1

Figure 4-6.—Sample long-range training schedule.

The preparation of the quarterly training plan is the responsibility of the training officer who submits the schedule after consultation with the training board and commanding officer at the beginning of each quarter.

Figure 4-7 is a sample quarterly training plan. The discussion which follows is based on the entries shown in the sample.

The General Record (Type I) lends itself perfectly to the quarterly plan. Addition of another one-inch column to the left of those already provided will accommodate five weeks of scheduling. Three of these forms are needed in each quarterly schedule as one form covers only a one-month period.

Items 1 and 2 (fig. 4-7) are self-descriptive and based on entries found in the Fleet/Type Commander's Quarterly Employment Schedule. Item 3 indicates any pending personnel, material, lower decks, inspections, while item 4 shows special concurrent requirements the ship may encounter (reserve cruise, opposed sortie, EWEX). Item 5 is self-explanatory. Item 6 indicates either by long title or number the team training for a given week. Item 7 shows individual training by course number. Item 8 indicates planned GQ or other exercises such as Condition III watches, abandon ship, and man overboard. Items 9 and 10 show, by department, the basic area of training (medical, nuclear defense) and specific training analogous to each department. Training can be indicated by lecture or by a shipboard training key, if used.

Item 11 indicates any specialized lectures the crew might receive, other than those in a "basic training" category. Career counseling falls into this category. Item 12, used for officer's training, is self-explanatory. Item 13 shows the major emphasis for training in any given week. Items 14 and 15 indicate expected and attained training levels (Advanced, Intermediate, Basic, Not-Ready), with item 15 to be filled in at the end of each week, reflecting the success of the week's work. Item 16 displays any scheduled non-professional training (USAFI) group courses. Any major shipboard evolution would be displayed in item 17; this includes boiler cleaning, washdown, and topside painting.

Weekly Training Schedule

The Weekly Training Schedule serves as a guide for the ship's training effort during each weekly period. It shows the same information that is carried on the long-range training schedule plus detailed plans for the following:

1. Operational drills and team training.
2. Division and interdivision instruction periods.
3. Officer training periods.

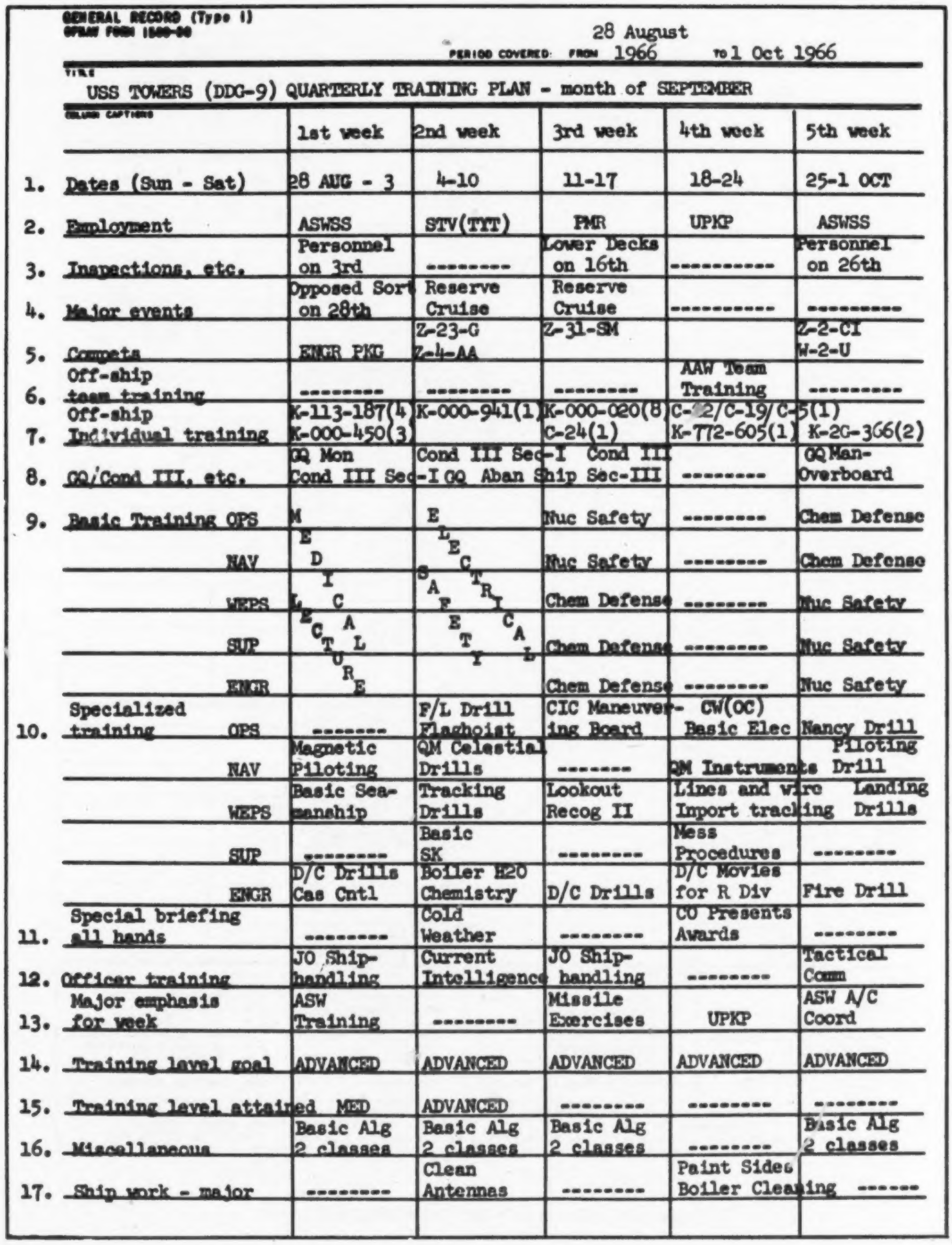
Since the form (fig. 4-8) provides for listing major maintenance activities, tests, and inspections, it can function also as a Plan of the Week. In major combatant ships, the weekly training schedule may be limited in scope to individual departments at the discretion of the commanding officer, and may be modified as desired.

The basic data needed to firm up each week's schedule will already have been recorded in other schedules. It is necessary only to make adjustments resulting from changes of plans for any items shown on the long-range schedule (and on which the tentative schedules for division drills and instruction periods have been based), and to assign firm hours of each day during which the drills and instruction periods will be conducted.

A suggested seven-step procedure for coordinating the preparation, execution, and review of the weekly training schedule is outlined as follows:

1. About the middle of each week the training officer should consult with the executive and operations officers to determine the changes necessary in the plans shown on the long-range schedule for the coming week. There are a number of reasons why the predictions shown on the long-range schedule may not fit actual circumstances. The training officer should make necessary changes in the long-range schedule and then enter these data on the first eight lines of the weekly training schedule (OpNav Form 3500-21). Any blank space in the first eight lines may be used to enter overflow entries from another line (fig. 4-8).

2. All division officers should meet with the training officer for a short scheduling session to firm up entries on the next week's schedule for division drills and for division and interdivision instruction and officer instruction periods. Insofar as practicable, school call for all divisions should take place at some time during the day so that the divisions will not interfere with one another (for example, one division operating power tools while another has a lecture inside the echoing bulkheads). However, divisions should not be forced into the



GENERAL RECORD (Type I)
OPNAV FORM 1500-30

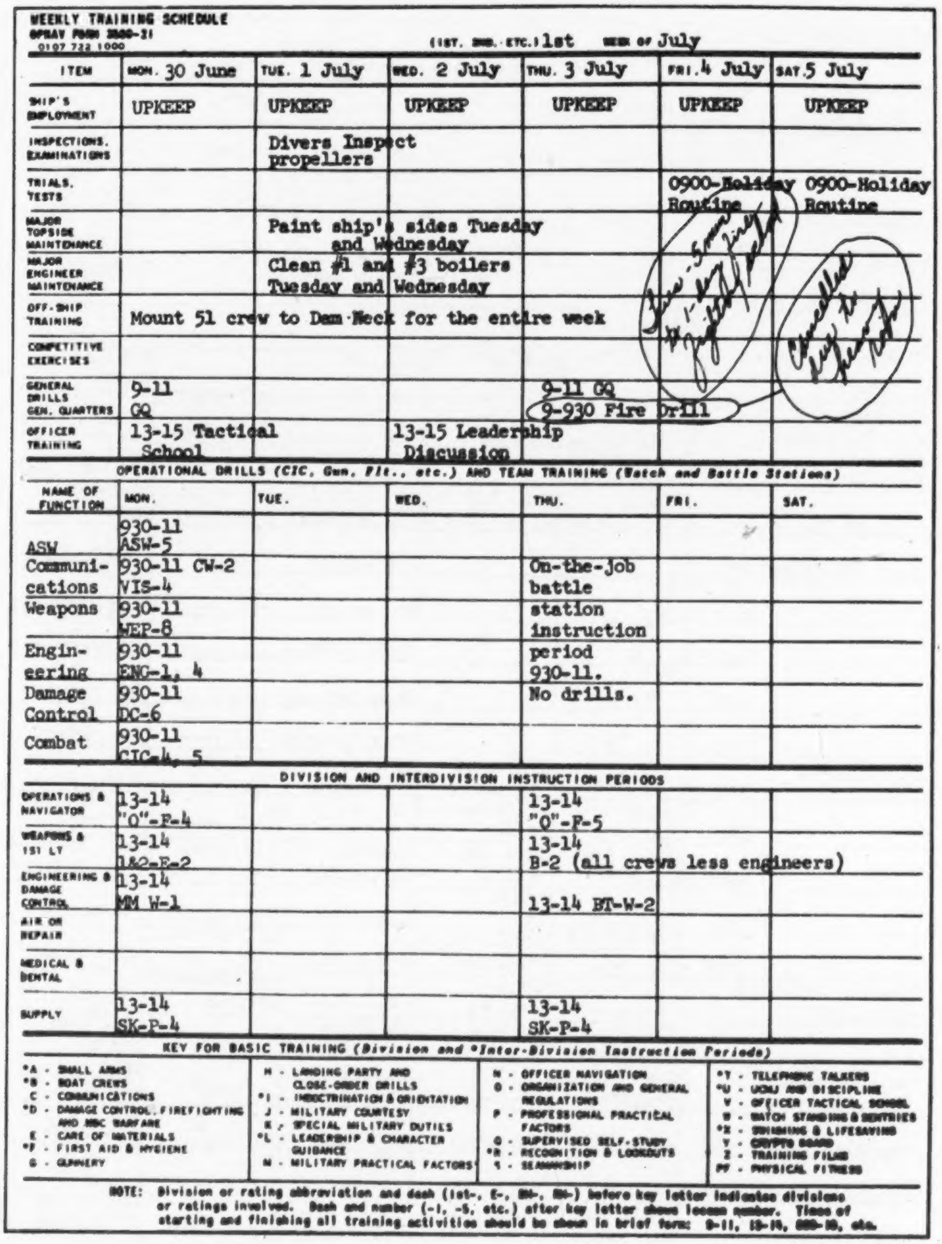
PERIOD COVERED: FROM 28 August 1966 TO 1 Oct 1966

TITLE
USS TOWERS (DDG-9) QUARTERLY TRAINING PLAN - month of SEPTEMBER

COLUMN CAPTIONS		1st week	2nd week	3rd week	4th week	5th week
1.	Dates (Sun - Sat)	28 AUG - 3	4-10	11-17	18-24	25-1 OCT
2.	Employment	ASWSS	STV(TYT)	PMR	UPKP	ASWSS
3.	Inspections, etc.	Personnel on 3rd	--------	Lower Decks on 16th	----------	Personnel on 26th
4.	Major events	Opposed Sort on 28th	Reserve Cruise	Reserve Cruise	----------	---------
5.	Compets	ENGR PKG	Z-23-G Z-4-AA	Z-31-SM		Z-2-CI W-2-U
6.	Off-ship team training	--------	--------	--------	AAW Team Training	---------
7.	Off-ship Individual training	K-113-187(4) K-000-450(3)	K-000-941(1)	K-000-020(8) C-24(1)	C-[illegible]2/C-19/C-5(1) K-772-605(1)	K-2G-366(2)
8.	GQ/Cond III, etc.	GQ Mon Cond III Sec-I	Cond III Sec-I GQ Aban Ship	Cond III Sec-III	--------	GQ Man-Overboard
9.	Basic Training OPS	MEDICAL LECTURE	ELECTRICAL SAFETY	Nuc Safety	--------	Chem Defense
	NAV			Nuc Safety	--------	Chem Defense
	WEPS			Chem Defense	--------	Nuc Safety
	SUP			Chem Defense	--------	Nuc Safety
	ENGR			Chem Defense	--------	Nuc Safety
10.	Specialized training OPS	-------	F/L Drill Flaghoist	CIC Maneuvering Board	CW(OC) Basic Elec	Nancy Drill
	NAV	Magnetic Piloting	QM Celestial Drills	-------	QM Instruments	Piloting Drill
	WEPS	Basic Seamanship	Tracking Drills	Lookout Recog II	Lines and wire Inport tracking	Landing Drills
	SUP	--------	Basic SK	--------	Mess Procedures	--------
	ENGR	D/C Drills Cas Cntl	Boiler H2O Chemistry	D/C Drills	D/C Movies for R Div	Fire Drill
11.	Special briefing all hands	--------	Cold Weather	--------	CO Presents Awards	--------
12.	Officer training	JO Shiphandling	Current Intelligence	JO Shiphandling	--------	Tactical Comm
13.	Major emphasis for week	ASW Training	--------	Missile Exercises	UPKP	ASW A/C Coord
14.	Training level goal	ADVANCED	ADVANCED	ADVANCED	ADVANCED	ADVANCED
15.	Training level attained	MED	ADVANCED	--------	--------	--------
16.	Miscellaneous	Basic Alg 2 classes	Basic Alg 2 classes	Basic Alg 2 classes	--------	Basic Alg 2 classes
17.	Ship work - major	--------	Clean Antennas	--------	Paint Sides Boiler Cleaning	------

24.1

Figure 4-7.—Sample quarterly training plan.



WEEKLY TRAINING SCHEDULE
OPNAV FORM 3500-21
0107 722 1000

(1ST, 2ND, ETC.) 1st WEEK OF July

ITEM	MON. 30 June	TUE. 1 July	WED. 2 July	THU. 3 July	FRI. 4 July	SAT. 5 July
SHIP'S EMPLOYMENT	UPKEEP	UPKEEP	UPKEEP	UPKEEP	UPKEEP	UPKEEP
INSPECTIONS, EXAMINATIONS		Divers Inspect propellers				
TRIALS, TESTS					0900-Holiday Routine	0900-Holiday Routine
MAJOR TOPSIDE MAINTENANCE		Paint ship's sides Tuesday and Wednesday				
MAJOR ENGINEER MAINTENANCE		Clean #1 and #3 boilers Tuesday and Wednesday				
OFF-SHIP TRAINING	Mount 51 crew to Dam Neck for the entire week					
COMPETITIVE EXERCISES						
GENERAL DRILLS GEN. QUARTERS	9-11 GQ			9-11 GQ 9-930 Fire Drill		
OFFICER TRAINING	13-15 Tactical School		13-15 Leadership Discussion			

[illegible]

Cancelled [illegible]

OPERATIONAL DRILLS (*CIC, Gun, Flt., etc.*) AND TEAM TRAINING (*Watch and Battle Stations*)

NAME OF FUNCTION	MON.	TUE.	WED.	THU.	FRI.	SAT.
ASW	930-11 ASW-5					
Communications	930-11 CW-2 VIS-4			On-the-Job battle station instruction period 930-11. No drills.		
Weapons	930-11 WEP-8					
Engineering	930-11 ENG-1, 4					
Damage Control	930-11 DC-6					
Combat	930-11 CIC-4, 5					

DIVISION AND INTERDIVISION INSTRUCTION PERIODS

	MON.	TUE.	WED.	THU.	FRI.	SAT.
OPERATIONS & NAVIGATOR	13-14 "O"-P-4			13-14 "O"-P-5		
WEAPONS & 1ST LT	13-14 1&2-E-2			13-14 B-2 (all crews less engineers)		
ENGINEERING & DAMAGE CONTROL	13-14 MM W-1			13-14 BT-W-2		
AIR OR REPAIR						
MEDICAL & DENTAL						
SUPPLY	13-14 SK-P-4			13-14 SK-P-4		

KEY FOR BASIC TRAINING (*Division and *Inter-Division Instruction Periods*)

*A - SMALL ARMS
*B - BOAT CREWS
C - COMMUNICATIONS
*D - DAMAGE CONTROL, FIREFIGHTING AND ABC WARFARE
E - CARE OF MATERIALS
*F - FIRST AID & HYGIENE
G - GUNNERY
H - LANDING PARTY AND CLOSE-ORDER DRILLS
*I - INDOCTRINATION & ORIENTATION
J - MILITARY COURTESY
K - SPECIAL MILITARY DUTIES
*L - LEADERSHIP & CHARACTER GUIDANCE
M - MILITARY PRACTICAL FACTORS
N - OFFICER NAVIGATION
O - ORGANIZATION AND GENERAL REGULATIONS
P - PROFESSIONAL PRACTICAL FACTORS
Q - SUPERVISED SELF-STUDY
*R - RECOGNITION & LOOKOUTS
S - SEAMANSHIP
*T - TELEPHONE TALKERS
*U - UCMJ AND DISCIPLINE
V - OFFICER TACTICAL SCHOOL
W - WATCH STANDING & SENTRIES
*X - SWIMMING & LIFESAVING
Y - CRYPTO BOARD
Z - TRAINING FILMS
PF - PHYSICAL FITNESS

NOTE: Division or rating abbreviation and dash (1st-, E-, BM-, RM-) before key letter indicates divisions or ratings involved. Dash and number (-1, -5, etc.) after key letter shows lesson number. Times of starting and finishing all training activities should be shown in brief form: 9-11, 13-15, 830-10, etc.

24.2

Figure 4-8.—Sample weekly training schedule.

same pattern if this will interfere with other planned division activities.

3. The filled in schedule should be returned to the training officer, who should make a final check of all entries to ensure that they are properly coordinated. He then should submit

the completed rough schedule to the executive officer for final approval.

4. The approved schedule should be typed and copies distributed to the OOD (original copy for master file), the wardroom bulletin board, CPO quarters, bulletin board outside ship's office, and to such other areas as may be desired.

5. The schedule for each day should be incorporated into the published plan of the day, incorporating any last-minute changes.

6. If an event is completed in accordance with the weekly training schedule, the quartermaster of the watch should make no notation on the master copy; but if any scheduled inspection, competitive exercise, GQ period, or operational drill is not completed, he should make a notation on the face of the weekly schedule. The item not completed may be circled or otherwise marked and an explanatory note added. The OOD is not expected to monitor the completion of division and interdivision instruction periods.

7. The marked-up master copy of the weekly schedule should be returned to the training officer at the end of the week and filed in a three-ring binder for future reference and analysis.

Names of instructors and places where lectures and movies will be held should be shown on the weekly schedule when space permits, or on an attached list which can also be published in the plan of the day.

NAVAL SCHOOL TRAINING PROGRAM

Only the Naval School Training Program which supplements the shipboard training program is discussed in this chapter. Except for such types of training as may be assigned other commands, the Bureau of Naval Personnel is responsible for the naval school training program applicable to the personnel of the engineering department. The school training program for which the Bureau of Naval Personnel is responsible provides officer training, enlisted training, functional training, and officer candidate training. The Formal Schools Catalog, NavPers 91769 (revised), presents a compilation of general information concerning courses conducted at training activities which receive primary support from the Chief of Naval Personnel. The catalog also contains information concerning colleges under joint command, foreign staff colleges and schools of other branches of the armed services in which the Chief of Naval Personnel is granted a student quota.

OFFICER TRAINING

Officer training includes advanced education of commissioned officers at the Naval War College and at three other colleges operated jointly by the Army and the Navy; postgraduate training at the Naval Postgraduate School, and at associated civilian universities; and special and technical training (such as damage control, NBC warfare defense, electronics, and naval justice) conducted at Naval Schools.

A complete understanding of our nation's policies and the correct conception of the strategy necessary for success in national and international enterprises are essential for higher command. It is considered necessary that every career naval officer possess a thorough knowledge of the principles and methods of naval strategy and tactics and of joint operations with other branches of the Armed Forces. He must have sufficient knowledge to correctly interpret the strategic and tactical decisions of the nation's leaders.

Four command and staff schools provide courses of advanced education for commissioned officers:

1. The Naval War College in Newport, Rhode Island, an activity under the supervision of the Chief of Naval Operations.

2. The Armed Forces Staff College in Norfolk, Virginia, a joint college under the technical direction and supervision of the Joint Chiefs of Staff.

3. The Industrial College of the Armed Forces in Washington, D.C., a joint college under the jurisdiction of the Joint Chiefs of Staff, with the Army responsible for budget and maintenance.

4. The National War College in Washington, D. C., a joint college under the technical direction and supervision of the Joint Chiefs of Staff, with the Army responsible for budget and maintenance.

The Navy provides postgraduate training in many fields for selected commissioned officers. Postgraduate education is not necessarily a deviation from a career of unrestricted general line service, nor is it a prerequisite for a successful career as a line officer. Unrestricted line officers who have completed a postgraduate education, however, normally serve one or several tours of duty in the field of their postgraduate study, incident to sea-shore rotation. Postgraduate education is conducted at the Naval Postgraduate School in Monterey, California, and at participating civilian institutions of higher learning.

Special and technical schools for officers provide courses normally attended by junior officers and range from 1 week to 12 months in length. The special training course for officers conducted at the Naval School, Boilermen, Class B, in Philadelphia, is of particular interest to officers of the engineering department. The course is comprised of the first 2 1/2 weeks of the Class B course and serves to acquaint officers with the operating principles of naval boilers.

ENLISTED TRAINING

BuPers-controlled schools for enlisted personnel are designed to provide training for individuals at successively higher levels. Naval Schools, Class A, cover the ground work for general ratings and the curriculums include most of the technical qualifications for advancement to petty officer third class. Naval Schools, Class B, provide formal training in technical qualifications for advancement in rating to first class and chief petty officer, while Naval Schools, Class C, provide special training in a particular job qualification or skill. U. S. Naval Schools, Class P, provide special preparatory or basic training. The Naval School, Class P, at Great Lakes, Illinois, provides a course of instruction in basic electricity and in basic electronics.

The Chief of Naval Personnel controls the assignment of personnel for instruction at enlisted schools. He may direct the transfer of personnel (1) by assigning quotas to commands afloat, (2) by assigning quotas for newly enlisted personnel upon completion of recruit training, and (3) by designating personnel as a result of their own requests.

Naval Schools, Class A, provide training for advancement to various ratings including those of electrician's mate, interior communications electrician, machinery repairman, machinist's mate, engineman, boilerman, shipfitter, and yeoman. Naval Schools, Class B, provide training for advancement in various ratings including those of electrician's mate, interior communications electrician, boilerman, machinery repairman, and yeoman. Naval Schools, Class C, provide special training for many ratings of the engineering department in such subjects as air conditioning, refrigeration, compressed gases, internal combustion engines, interior communications, motion picture equipment, leadership, methods of instruction, and welding.

FUNCTIONAL TRAINING

Functional training provides instruction for officers and enlisted personnel (often as a team) and consists of training in specialized functions which do not fit into the normal pattern of other schools for officers or enlisted personnel. Some functional training activities are under the administrative control of the Chief of Naval Personnel and others are administered by Fleet Commanders but receive support from the Bureau of Naval Personnel.

Naval functional training activities provide a variety of courses including courses concerning damage control, engineering, deep sea diving, and nuclear power. The following fleet training activities provide short functional training courses of interest to engineering personnel: (1) Fleet Training Centers (Norfolk, Charleston, Newport, and San Diego); (2) Naval Submarine School (New London); (3) Fleet Submarine Training Facility (Pearl Harbor); (4) Naval Amphibious School (Little Creek); and (5) Destroyer School (Newport).

NAVY ENLISTED SCIENTIFIC EDUCATION PROGRAM

The Navy Enlisted Scientific Education Program (NESEP) was established to provide for the education of highly qualified personnel in the scientific and engineering fields, to cope with the problems and complexities of modern warfare. NESEP provides an uninterrupted (including summer sessions) 4-year college education leading to a commission in the U. S. Navy. The program is available to certain highly qualified enlisted personnel. Colleges in 21 states participate in the program and assignment to a certain college is made on the basis of individual preference, legal residence, and local conditions such as personal problems which might pertain. Students maintain their enlisted status while enrolled in the program and will be eligible for advancement in accordance with the normal procedures applicable to other enlisted personnel, including servicewide examinations. Upon completion of the 4-year course of instruction (baccalaureate level), graduates will be ordered to Officer Candidate School, Newport, or the Naval School, Pre-Flight, Pensacola. Upon successful completion of the officer candidate or pre-flight course, students, if qualified, are commissioned in the U. S. Navy in a category commensurate with the needs of the service.

The quota for NESEP is set annually by the Chief of Naval Personnel. Applications for the program are requested annually in accordance with the latest revision of BuPers Instruction 1510-69.

Selectees receive preliminary intensive instruction at the U. S. Naval Preparatory School, Bainbridge, during the summer preceding their college entrance. Prior to being transferred to a college, each selectee must have obligated service of 6 years; upon completion of the second year of college, he must agree to extend his enlistment for 2 additional years.

CHAPTER 5

SHIP MAINTENANCE

Maintenance of ships can be divided into two broad categories: preventive maintenance and corrective maintenance. Preventive maintenance consists of routine shipboard procedures designed to increase the effective life of equipment or forewarn of impending troubles. Corrective maintenance includes procedures designed to analyze and correct material defects and troubles. The main objective of shipboard preventive maintenance is the prevention of breakdown, deterioration, and malfunction of equipment. If, however, this objective is not reached, the alternative objective of repairing or replacing the failed equipment—corrective maintenance—must be accomplished.

Shipboard maintenance programs in the past have varied from one command to another, resulting in various degrees of operational readiness. A relatively new, uniform system of scheduling, recording, reporting, and managing ship maintenance is now in use. This system, the Navy Maintenance and Material Management (3-M) System, was initially installed in the engineering departments of selected ships; the system has now been (or soon will be) installed in all departments of all active ships.

The basic purpose of the 3-M System is to increase the operational readiness of the fleet through a planned system of scheduled (preventive) maintenance. To accomplish this objective, the 3-M System standarizes preventive maintenance requirements, procedures, and reports on a fleetwide basis. Once the 3-M system is installed and working, it will probably be noticed that many maintenance requirements are simplified as well as standardized.

Although the 3-M System standarizes preventive maintenance, it also establishes specific maintenance requirements for the systems, subsystems, and equipment on each ship. In other words, the 3-M System is individually tailored to each ship. An example may help to illustrate this point. Before the establishment of the 3-M System, there was a general preventive maintenance requirement to "sample and inspect lube oil weekly" on all auxiliary turbines. Under the 3-M System, this requirement is specifically spelled out for each turbine-driven auxiliary (main feed pump, feed booster pump, condensate pump, and forced draft blowers) installed on each ship. When the 3-M System is installed on a ship, therefore, it is no longer necessary for ship's force to take general maintenance requirements and apply them to their own equipment; instead, the requirements are made specific for every system, subsystem, and component that is actually found on that particular ship.

The 3-M System is relatively simple, logical, and easy to follow. Like most systems, however, this one is not foolproof and it will not run by itself. The 3-M System imposes certain definite responsibilities on everybody aboard ship, from the commanding officer on down. When working with the 3-M System, one should understand what the 3-M System is designed to accomplish and understand the details of operation of the system, adhere to the schedules established by the 3-M System, make neat, accurate, and complete entries of all required data on all required forms, and keep informed of changes that occur in the 3-M System.

The information given in this chapter is as up to date as possible at the time of writing (1968). However, it is important to realize that the 3-M System is still quite new and subject to change. Since the 3-M System will undoubtedly have far-reaching consequences on all shipboard maintenance, every effort must be made to keep up with new developments in the program. The basic source of information is the Maintenance and Material Management (3-M) Manual, OPNAV 43P2, of March 1965 (and, of course, all later changes, supplements, or revisions that may be issued). Other sources of information on the 3-M System include OPNAV INSTRUCTIONS and directives issued by the type commander.

The 3-M System includes the Planned Maintenance Subsystem (PMS) and the Maintenance Data Collection Subsystem (MDCS). On repair ships and tenders, a Manhour Accounting System is also included. This chapter presents an overall view of the 3-M System.

PLANNED MAINTENANCE SUBSYSTEM

Since the Planned Maintenance Subsystem deals with scheduled preventive maintenance rather than with corrective maintenance, it is important to understand the use of these terms.

PREVENTIVE MAINTENANCE is the sum of those actions performed on operational equipment that contribute to uninterrupted operation of the equipment within design characteristics.

CORRECTIVE MAINTENANCE is the sum of those actions required to restore equipment to an operational condition within predetermined tolerances or limitations.

The Planned Maintenance Subsystem establishes certain minimum maintenance requirements for each system, subsystem, or component. In establishing these minimum maintenance requirements, all applicable documents (the Naval Ships Technical Manual, manufacturers' technical manuals, and drawings) are critically examined and evaluated. If maintenance requirements are found to be unrealistic or unclear, they are modified or completely revised before being incorporated into the PMS.

It is possible that the preventive maintenance prescribed in the PMS may be in conflict with that prescribed in other official documents. If such a conflict exists, remember that the PMS takes precedence over any and all other documents, including the Naval Ships Technical Manual, the manufacturers' technical manuals, and the applicable drawings.

It should be noted, however, that the PMS does NOT cover certain operating checks and inspections that are required as a normal part of the regular watchstanding routine. For example, such items as hourly pressure and temperature checks or routine oil level checks will not be listed as maintenance requirements under the PMS. Even though these routine operating checks are not listed as PMS requirements, they must still be performed in accordance with all applicable instructions.

The Planned Maintenance Subsystem is based upon the proper utilization of PMS Manuals, Maintenance Requirement Cards (MRCs), and schedules for the accomplishment of planned maintenance actions.

PMS MANUAL

A master PMS Manual is furnished to each ship as part of the installation of the 3-M System. The master manual contains the minimum planned maintenance requirements for each maintainable system, subsystem, and component installed in that particular ship. The master manual contains a section for each department; the departmental sections are kept in the departmental offices and are used by department heads in planning and scheduling departmental maintenance.

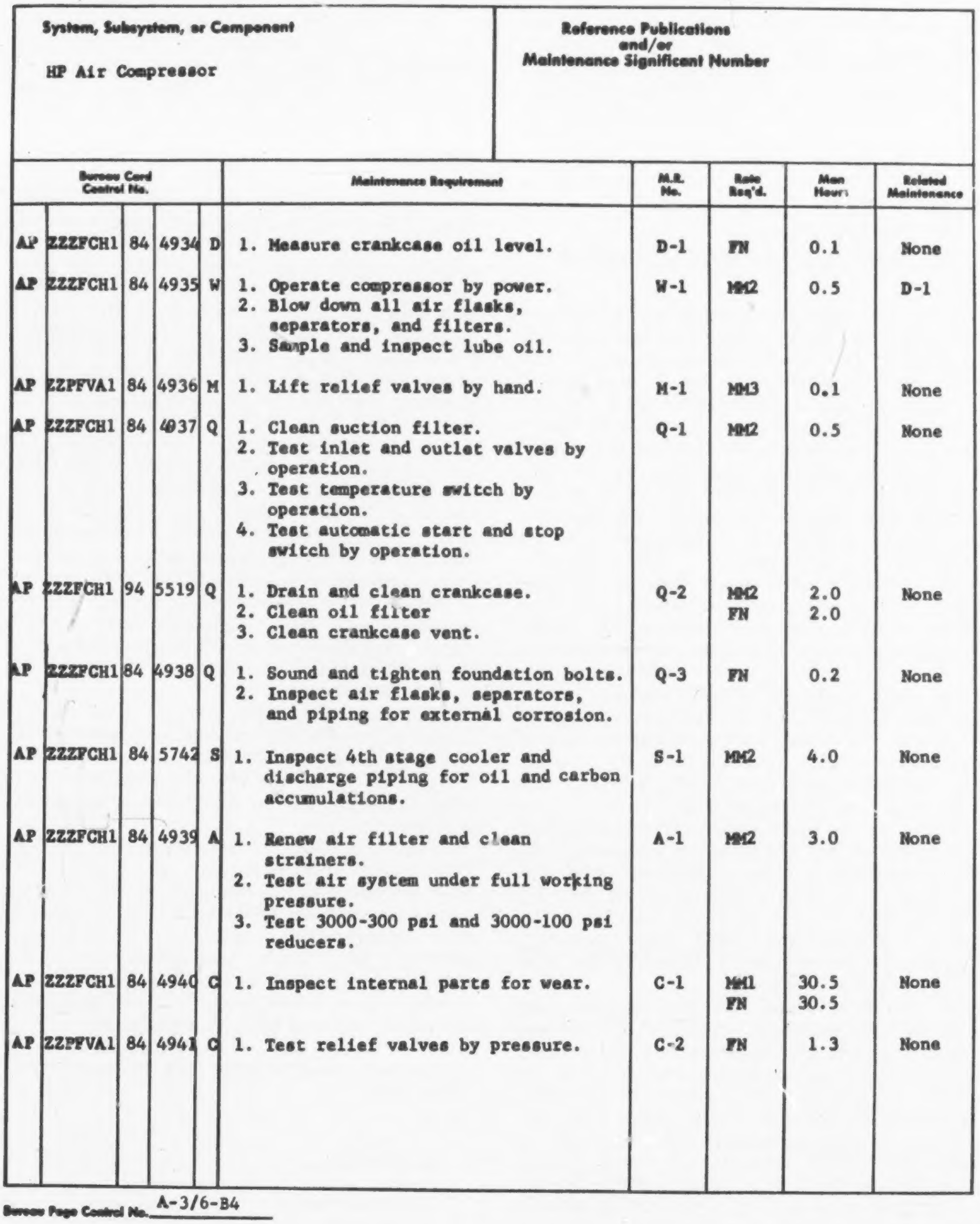
The engineering department PMS Manual is sectioned by maintenance groups. In the PMS, a maintenance group is defined as a group of people who work together for the accomplishment of maintenance requirements on assigned equipment, under the supervision of a maintenance group supervisor (a petty officer). The number of maintenance groups varies according to the size and type of ship. Applicable portions of the engineering department PMS Manual are kept in the working space for each engineering department maintenance group.

The engineering department PMS Manual contains introductory information, lists of effective pages, and a number of Maintenance Index Pages. There is one Maintenance Index Page (MIP) for each system, subsystem, or component involved.

Figure 5-1 shows a Maintenance Index Page (MIP) taken from a typical PMS Manual. The MIP identifies the system, subsystem, or component involved and gives a short description of each maintenance requirement. The column marked "M.R. No." gives the number of the maintenance requirement. This number is a combination of a letter, which indicates the frequency of the maintenance requirement, and a number, which indicates the sequence of the maintenance requirements. The frequency letter codes are:

D—Daily
W—Weekly
M—Monthly
Q—Quarterly
S—Semiannually
A—Annually

81



System, Subsystem, or Component	Reference Publications and/or Maintenance Significant Number
HP Air Compressor	

Bureau Card Control No.	Maintenance Requirement	M.R. No.	Rate Req'd.	Man Hours	Related Maintenance
AP ZZZFCH1 84 4934 D	1. Measure crankcase oil level.	D-1	FN	0.1	None
AP ZZZFCH1 84 4935 W	1. Operate compressor by power. 2. Blow down all air flasks, separators, and filters. 3. Sample and inspect lube oil.	W-1	MM2	0.5	D-1
AP ZZPFVA1 84 4936 M	1. Lift relief valves by hand.	M-1	MM3	0.1	None
AP ZZZFCH1 84 4937 Q	1. Clean suction filter. 2. Test inlet and outlet valves by operation. 3. Test temperature switch by operation. 4. Test automatic start and stop switch by operation.	Q-1	MM2	0.5	None
AP ZZZFCH1 94 5519 Q	1. Drain and clean crankcase. 2. Clean oil filter 3. Clean crankcase vent.	Q-2	MM2 FN	2.0 2.0	None
AP ZZZFCH1 84 4938 Q	1. Sound and tighten foundation bolts. 2. Inspect air flasks, separators, and piping for external corrosion.	Q-3	FN	0.2	None
AP ZZZFCH1 84 5742 S	1. Inspect 4th stage cooler and discharge piping for oil and carbon accumulations.	S-1	MM2	4.0	None
AP ZZZFCH1 84 4939 A	1. Renew air filter and clean strainers. 2. Test air system under full working pressure. 3. Test 3000-300 psi and 3000-100 psi reducers.	A-1	MM2	3.0	None
AP ZZZFCH1 84 4940 C	1. Inspect internal parts for wear.	C-1	MM1 FN	30.5 30.5	None
AP ZZPFVA1 84 4941 C	1. Test relief valves by pressure.	C-2	FN	1.3	None

Bureau Page Control No. A-3/6-B4

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Figure 5-1.—Maintenance Index Page.

C—Overhaul Cycle

R—Situation Requirement (Every 100 hours, after 600 hours of steaming, before lighting off, etc.)

The first daily maintenance requirement is identified as D-1, the second as D-2, the third as D-3, and so forth. Similarly, the first weekly maintenance requirement is identified as W-1, the second as W-2, and so forth.

The Maintenance Index Page (MIP) also gives the rate or rates recommended to perform the maintenance requirement, the average manhours required to perform the maintenance, and any related additional maintenance actions to be accomplished before, in conjunction with, or after the scheduled maintenance requirement.

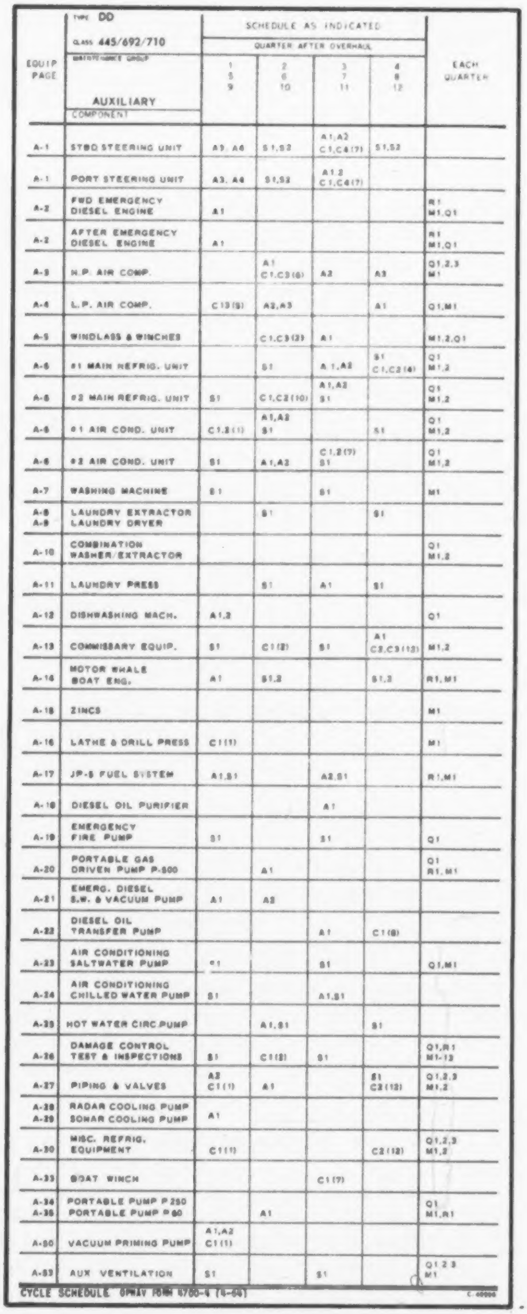
Because shipboard applications of the PMS vary slightly from one ship to another, the information found on the MIPs regarding rates recommended to perform the maintenance and the average time required for the task requires some clarification. The maintenance tasks are actually performed by available, capable personnel; the rate or rates listed on the MIP are to be used as a guide rather than as a definite requirement. The average time listed on the MIP does not take account of the time required to assemble the necessary tools and materials nor the time required to clean up the area and put away the tools after the maintenance task has been completed. It is important to remember that no maintenance action is really finished until all tools and equipment have been put away and the area has been cleaned.

MAINTENANCE SCHEDULES

Scheduling of planned maintenance under the PMS is accomplished through the use of various schedules.

The CYCLE SCHEDULE, shown in figure 5-2, is a visual display of preventive maintenance requirements based on the overhaul cycle of the ship. The cycle schedule contains the following information:

1. The Maintenance Index Page Number of each item, taken from the PMS Manual.
2. A listing, by maintenance group, of all equipment on board that requires preventive maintenance.
3. Scheduling of the semiannual, annual, and overhaul cycle maintenance requirements into "quarters after overhaul."
4. Quarterly, monthly, and situation maintenance requirements that must be scheduled



EQUIP PAGE	TYPE DD CLASS 445/692/710 MAINTENANCE GROUP AUXILIARY COMPONENT	SCHEDULE AS INDICATED				EACH QUARTER
		QUARTER AFTER OVERHAUL				
		1 5 9	2 6 10	3 7 11	4 8 12	
A-1	STBD STEERING UNIT	A3, A4	S1,S2	A1,A2 C1,C4(7)	S1,S2	
A-1	PORT STEERING UNIT	A3, A4	S1,S2	A1,2 C1,C4(7)		
A-2	FWD EMERGENCY DIESEL ENGINE	A1				R1 M1,Q1
A-2	AFTER EMERGENCY DIESEL ENGINE	A1				R1 M1,Q1
A-3	H.P. AIR COMP.		A1 C1,C3(6)	A2	A3	Q1,2,3 M1
A-4	L.P. AIR COMP.	C13(5)	A2,A3		A1	Q1,M1
A-5	WINDLASS & WINCHES		C1,C3(2)	A1		M1,2,Q1
A-6	#1 MAIN REFRIG. UNIT		S1	A1,A2	S1 C1,C2(4)	Q1 M1,2
A-6	#2 MAIN REFRIG. UNIT	S1	C1,C2(10)	A1,A2 S1		Q1 M1,2
A-6	#1 AIR COND. UNIT	C1,2(1)	A1,A2 S1		S1	Q1 M1,2
A-6	#2 AIR COND. UNIT	S1	A1,A2	C1,2(7) S1		Q1 M1,2
A-7	WASHING MACHINE	S1		S1		M1
A-8 A-9	LAUNDRY EXTRACTOR LAUNDRY DRYER		S1		S1	
A-10	COMBINATION WASHER/EXTRACTOR					Q1 M1,2
A-11	LAUNDRY PRESS		S1	A1	S1	
A-12	DISHWASHING MACH.	A1,2				Q1
A-13	COMMISSARY EQUIP.	S1	C1(2)	S1	A1 C2,C3(12)	M1,2
A-14	MOTOR WHALE BOAT ENG.	A1	S1,2		S1,2	R1,M1
A-15	ZINCS					M1
A-16	LATHE & DRILL PRESS	C1(1)				M1
A-17	JP-5 FUEL SYSTEM	A1,S1		A2,S1		R1,M1
A-18	DIESEL OIL PURIFIER			A1		
A-19	EMERGENCY FIRE PUMP	S1		S1		Q1
A-20	PORTABLE GAS DRIVEN PUMP P-500		A1			Q1 R1,M1
A-21	EMERG. DIESEL S.W. & VACUUM PUMP	A1	A2			
A-22	DIESEL OIL TRANSFER PUMP			A1	C1(8)	
A-23	AIR CONDITIONING SALTWATER PUMP	S1		S1		Q1,M1
A-24	AIR CONDITIONING CHILLED WATER PUMP	S1		A1,S1		
A-25	HOT WATER CIRC.PUMP		A1,S1		S1	
A-26	DAMAGE CONTROL TEST & INSPECTIONS	S1	C1(2)	S1		Q1,R1 M1-12
A-27	PIPING & VALVES	A2 C1(1)	A1		S1 C2(12)	Q1,2,3 M1,2
A-28 A-29	RADAR COOLING PUMP SONAR COOLING PUMP	A1				
A-30	MISC. REFRIG. EQUIPMENT	C1(1)			C2(12)	Q1,2,3 M1,2
A-33	BOAT WINCH			C1(7)		
A-34 A-35	PORTABLE PUMP P250 PORTABLE PUMP P60		A1			Q1 M1,R1
A-50	VACUUM PRIMING PUMP	A1,A2 C1(1)				
A-53	AUX VENTILATION	S1		S1		Q1 2 3 M1

CYCLE SCHEDULE OPNAV FORM 4700-4 (4-66)

98.172

Figure 5-2.—Cycle schedule.

every quarter. (Monthly requirements must be scheduled every month of the quarter.)

The cycle schedule is maintained in the departmental office and is used by the department head for preparing the quarterly schedules.

By definition, the day a ship leaves the shipyard is in the first quarter after overhaul. A ship is not necessarily expected to perform all of the planned maintenance listed for the first quarter after overhaul, but the amount performed must be in proportion to the time remaining in that particular quarter. The steps to follow in using the cycle schedule can best be explained by reference to figure 5-2. Consider, for example, the planned maintenance required for the #1 main refrigeration unit. As indicated on the cycle schedule, a brief description of the maintenance required may be found on page A-6 of the Planned Maintenance Subsystem Manual. From the cycle schedule, it is apparent that the maintenance must be scheduled as follows:

M1 and M2	Each Month
Q1	Each Quarter
S1	2nd, 4th, 6th, 8th, 10th, and 12th quarters after overhaul
A1 and A2	3rd, 7th, and 11th quarters after overhaul
C1 and C2	4th quarter after overhaul (denoted by the numeral "4" in parenthesis on cycle schedule).

The QUARTERLY SCHEDULE is a visual display consisting of two identical quarterly schedule forms, one, such as shown in figure 5-3, for the current quarter and one for the subsequent quarter. The quarterly schedule, which is a very important part of the PMS, is prepared by the department head in conjunction with the division officers and maintenance group supervisors. The quarterly schedule, which is updated weekly, provides a ready shipboard reference for the current status of preventive maintenance for each maintenance group. Each quarterly schedule contains:

1. A block for the maintenance group involved.

2. Blocks in which to insert the current year, quarter after overhaul number, and months.

3. A block in which to write the ship's employment schedule. This block is divided into days by tick marks, in order to allow for an accurate picture of the ship's operating schedule. Scheduling of maintenance must be in accordance with the requirements of ship operation.

4. Thirteen columns, one for each week in the quarter, for the scheduling of maintenance requirements on a weekly basis throughout the three-month period. Note that the quarterly schedule bears no relationship to installation date. The date a ship leaves overhaul is the first quarter after overhaul. Ships leaving overhaul late in the quarter are not expected to complete all preventive maintenance during that quarter, but they should accomplish a proportionate share based upon the time remaining in the quarter.

The quarterly schedule is displayed next to the cycle schedule, in a visual display holder known as the maintenance control board, and is used in the following way:

1. The blocks at the top of the schedule are filled in with the appropriate information.

2. The quarterly employment schedule of the ship is filled in. A line is drawn through the tick marks for the anticipated "at sea" days.

3. The maintenance requirements are transcribed from the appropriate "quarter after overhaul" column of the cycle schedule to the specific week on the CURRENT quarterly schedule when the work can best be accomplished. SUBSEQUENT quarterly schedules are placed to the right of the current quarterly schedule to provide continuity.

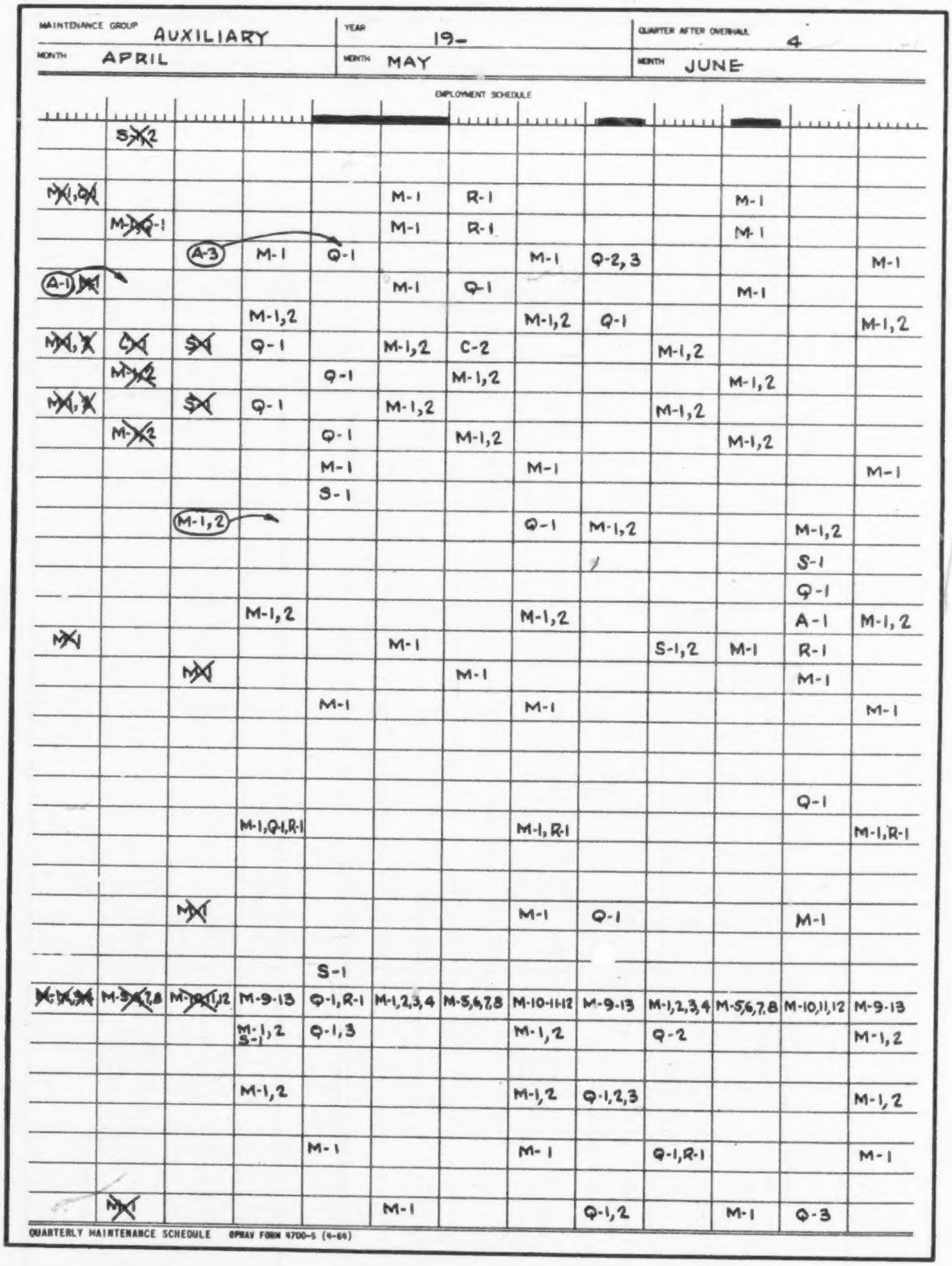
4. At the end of each week, the maintenance group supervisor crosses out (with an X) all the maintenance requirements that have been accomplished and circles all requirements that have NOT been accomplished. All circled requirements must be rescheduled. The maintenance group supervisor uses the weekly schedule to perform this weekly updating of the quarterly schedule.

5. Any semiannual, annual, or overhaul cycle requirement that cannot be accomplished during the current quarter must be rescheduled on the subsequent quarterly schedule.

6. The completed quarterly schedule is removed from its holder and retained as a record of preventive maintenance accomplished, at the close of each quarter. The quarterly schedule may be discarded at the beginning of the second quarter after the next overhaul.

7. The subsequent quarterly schedule is moved to the left to become the new current quarterly schedule, and a new subsequent quarterly schedule is posted.

The WEEKLY SCHEDULE (fig. 5-4) is a visual display of preventive maintenance required within a maintenance group work area. The



MAINTENANCE GROUP AUXILIARY
YEAR 19-
QUARTER AFTER OVERHAUL 4
MONTH APRIL
MONTH MAY
MONTH JUNE

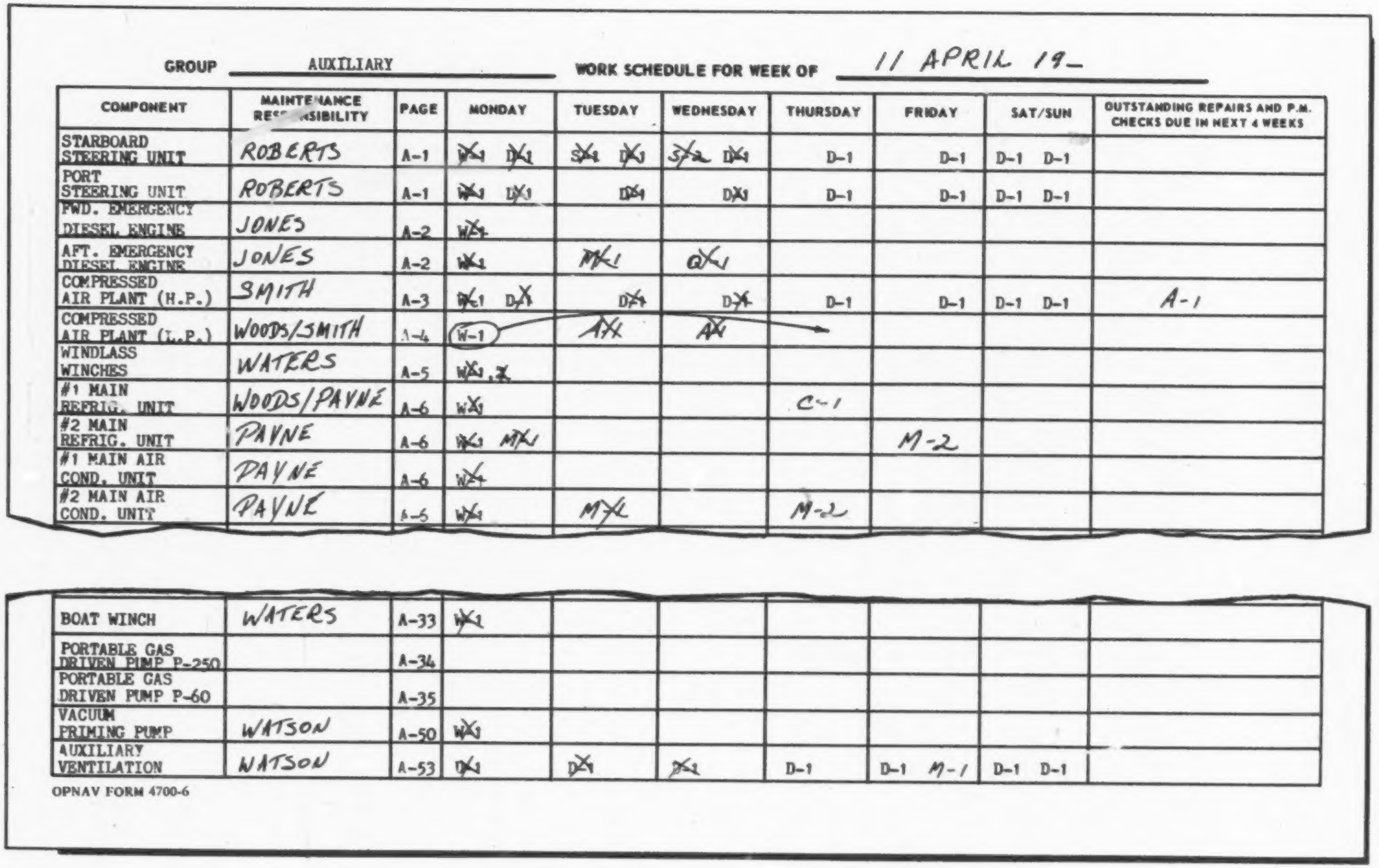
EMPLOYMENT SCHEDULE

	~~S-1,2~~											
~~M-1,Q-1~~					M-1	R-1				M-1		
	~~M-1,Q-1~~				M-1	R-1				M-1		
		A-3	M-1	Q-1			M-1	Q-2, 3				M-1
A-1 ~~M-1~~					M-1	Q-1				M-1		
			M-1,2				M-1,2	Q-1				M-1,2
~~M-1,2~~	~~C-1~~	~~S-1~~	Q-1		M-1,2	C-2			M-1,2			
	~~M-1,2~~			Q-1		M-1,2				M-1,2		
~~M-1,2~~		~~S-1~~	Q-1		M-1,2				M-1,2			
	~~M-1,2~~			Q-1		M-1,2				M-1,2		
				M-1			M-1					M-1
				S-1								
		M-1,2					Q-1	M-1,2			M-1,2	
											S-1	
											Q-1	
			M-1,2				M-1,2				A-1	M-1, 2
~~M-1~~					M-1				S-1,2	M-1	R-1	
		~~M-1~~				M-1					M-1	
				M-1			M-1					M-1
											Q-1	
			M-1,Q-1,R-1				M-1, R-1					M-1,R-1
		~~M-1~~					M-1	Q-1			M-1	
				S-1								
~~M-1,2,3,4~~	~~M-5,6,7,8~~	~~M-9,10,11,12~~	M-9-13	Q-1, R-1	M-1,2,3,4	M-5,6,7,8	M-10-11-12	M-9-13	M-1,2,3,4	M-5,6,7,8	M-10,11,12	M-9-13
			M-1,2 S-1	Q-1,3			M-1,2		Q-2			M-1,2
			M-1,2				M-1,2	Q-1,2,3				M-1, 2
				M-1			M-1		Q-1,R-1			M-1
	~~M-1~~				M-1			Q-1,2		M-1	Q-3	

QUARTERLY MAINTENANCE SCHEDULE OPNAV FORM 4700-5 (4-64)

Figure 5-3.—Quarterly schedule.

98.173



GROUP AUXILIARY WORK SCHEDULE FOR WEEK OF 11 APRIL 19_

COMPONENT	MAINTENANCE RESPONSIBILITY	PAGE	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SAT/SUN	OUTSTANDING REPAIRS AND P.M. CHECKS DUE IN NEXT 4 WEEKS
STARBOARD STEERING UNIT	ROBERTS	A-1	~~W-1~~ ~~D-1~~	~~S-1~~ ~~D-1~~	~~S-2~~ ~~D-1~~	D-1	D-1	D-1 D-1	
PORT STEERING UNIT	ROBERTS	A-1	~~W-1~~ ~~D-1~~	~~D-1~~	~~D-1~~	D-1	D-1	D-1 D-1	
FWD. EMERGENCY DIESEL ENGINE	JONES	A-2	~~W-1~~						
AFT. EMERGENCY DIESEL ENGINE	JONES	A-2	~~W-1~~	~~M-1~~	~~Q-1~~				
COMPRESSED AIR PLANT (H.P.)	SMITH	A-3	~~W-1~~ ~~D-1~~	~~D-1~~	~~D-1~~	D-1	D-1	D-1 D-1	A-1
COMPRESSED AIR PLANT (L.P.)	WOODS/SMITH	A-4	W-1	~~A-1~~	~~A-1~~				
WINDLASS WINCHES	WATERS	A-5	~~W-1, 2~~						
#1 MAIN REFRIG. UNIT	WOODS/PAYNE	A-6	~~W-1~~			C-1			
#2 MAIN REFRIG. UNIT	PAYNE	A-6	~~W-1~~ ~~M-1~~				M-2		
#1 MAIN AIR COND. UNIT	PAYNE	A-6	~~W-1~~						
#2 MAIN AIR COND. UNIT	PAYNE	A-6	~~W-1~~	~~M-2~~		M-2			
BOAT WINCH	WATERS	A-33	~~W-1~~						
PORTABLE GAS DRIVEN PUMP P-250		A-34							
PORTABLE GAS DRIVEN PUMP P-60		A-35							
VACUUM PRIMING PUMP	WATSON	A-50	~~W-1~~						
AUXILIARY VENTILATION	WATSON	A-53	~~D-1~~	~~D-1~~	~~D-1~~	D-1	D-1 M-1	D-1 D-1	

OPNAV FORM 4700-6

Figure 5-4. —Weekly schedule.

weekly schedule posted in each maintenance group work area is used by the maintenance group supervisor to assign specific personnel to perform required maintenance action on specific equipment.

The weekly schedule provides the following information:

1. A list of components in the working area.
2. A roster for assigning maintenance requirements to specific personnel, by name.
3. Reference to the Maintenance Index Page (MIP) in the Planned Maintenance Subsystem Manual.
4. Columns for the days of the week. The daily and weekly maintenance requirements are preprinted in these columns; the other maintenance requirements are written in by the maintenance group supervisor.
5. A column for listing outstanding repairs and preventive maintenance checks due in the next 4 weeks. This column allows the maintenance group supervisor to list equipment corrective maintenance actions that are outstanding because they are beyond the capacity of ship's force, cannot be performed because of lack of spare parts or tools, or for other reasons. The repairs listed in this column are phased into the workload and accomplished in conjunction with regularly scheduled maintenance, as time and circumstances permit.

The weekly schedule is used in the following way:

1. The maintenance group supervisor assigns work to individuals, by name; he utilizes the current quarterly schedule to obtain the maintenance requirements (other than daily and weekly) that should be scheduled for this particular week. He enters these maintenance requirements in the appropriate personnel line of the appropriate daily columns.
2. Each man assigned is responsible for completing the work assigned on the day it is scheduled.
3. When the maintenance group supervisor ascertains that the work has in fact been completed, he crosses out (with an X) the maintenance requirement number on the weekly schedule. If the maintenance requirement cannot be completed on schedule, the maintenance group supervisor circles the maintenance requirement number on the weekly schedule. All circled items must be rescheduled.
4. The maintenance group supervisor fills in the column provided for outstanding repairs.
5. At the end of each week, the maintenance group supervisor brings the quarterly schedule up to date by comparing it with the weekly schedule and crossing out completed items and circling items not completed.

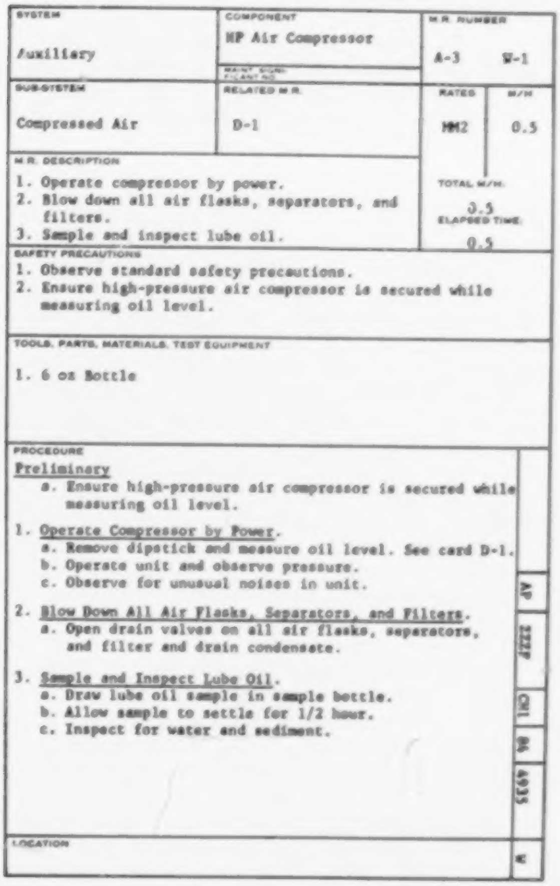
MAINTENANCE REQUIREMENT CARDS

Maintenance Requirement Cards may be thought of as the basic tools of the PMS. Each Maintenance Requirement Card (MRC) defines the preventive maintenance task in terms that allow everyone to know what is required in performing the job, standarizes the procedures for doing the job in the best known way, and expedites the accomplishment of the task by listing the tools and materials needed and the safety precautions that should be observed. There is a separate Maintenance Requirement Card for each maintenance action required on each system, subsystem, or component.

A Maintenance Requirement Card is shown in figure 5-5. As may be noted, an MRC contains the following information:

1. A word identification of the equipment (system, subsystem, and component).
2. A maintenance requirement number (M.R. Number) consisting of the Maintenance Index Page number and the frequency and periodicity code (D-3, W-1, Q-2, etc.).
3. Any related maintenance requirements. A related maintenance requirement is one that is related to the task being done in such a way that the tasks may be done at the same time in order to save time, money, and effort.
4. A description of the maintenance requirement. This is a brief statement of the maintenance action to be accomplished.
5. The rate or rates that are recommended for the accomplishment of the particular maintenance action, together with the average manhours and the average total time required to perform the maintenance action.
6. A list of special safety precautions, over and above the usual safe practices, that specifically apply to the particular maintenance task.
7. A list of the specific tools, parts, and materials required to do the job properly.
8. The detailed, step-by-step procedures to be followed in order to accomplish the maintenance action in the best known manner.
9. The card control number. This number (which also appears on the appropriate MIP)

87



SYSTEM
Auxiliary

COMPONENT
HP Air Compressor

M.R. NUMBER
A-3 W-1

MAINT. SIGN./PLANT NO.

SUB-SYSTEM
Compressed Air

RELATED M.R.
D-1

RATES
MM2

M/H
0.5

M.R. DESCRIPTION
1. Operate compressor by power.
2. Blow down all air flasks, separators, and filters.
3. Sample and inspect lube oil.

TOTAL M/H.
0.5

ELAPSED TIME
0.5

SAFETY PRECAUTIONS
1. Observe standard safety precautions.
2. Ensure high-pressure air compressor is secured while measuring oil level.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT
1. 6 oz Bottle

PROCEDURE

Preliminary
  a. Ensure high-pressure air compressor is secured while measuring oil level.

1. Operate Compressor by Power.
  a. Remove dipstick and measure oil level. See card D-1.
  b. Operate unit and observe pressure.
  c. Observe for unusual noises in unit.

2. Blow Down All Air Flasks, Separators, and Filters.
  a. Open drain valves on all air flasks, separators, and filter and drain condensate.

3. Sample and Inspect Lube Oil.
  a. Draw lube oil sample in sample bottle.
  b. Allow sample to settle for 1/2 hour.
  c. Inspect for water and sediment.

AP
2227
C01
86
4935
W

LOCATION

98.176

Figure 5-5.—Maintenance Requirement Card.

should be referred to in any correspondence concerning the Maintenance Requirement Card.

10. The location of the unit or component to be worked on.

11. In some instances, the MRC contains blanks that must be filled in by ship's force to indicate limiting speeds, tolerances, pressures, and other information needed for the proper execution of the maintenance task. This type of information is filled in by ship's force because the information varies from ship to ship.

A complete working set of Maintenance Requirement Cards is kept in a special container located in the maintenance group working area. The MRCs should be used as follows:

1. Remove the applicable MRCs from the working set.

2. Obtain the listed tools, parts, and materials.

3. Perform the maintenance requirement in accordance with the steps listed on the MRC. Observe the listed safety precautions and all other normal safety precautions required for the type of task.

4. Correct any deficiencies noted during the performance of the maintenance requirement; report any such deficiencies to the maintenance group supervisor.

5. Return the MRC to the container after the job has been completed.

6. Cross off the accomplished maintenance requirement on a weekly schedule. (This should be done by the maintenance group supervisor.)

7. If any casualty, potential casualty, or defect is noted during the performance of the maintenance action, report this fact to the maintenance group supervisor.

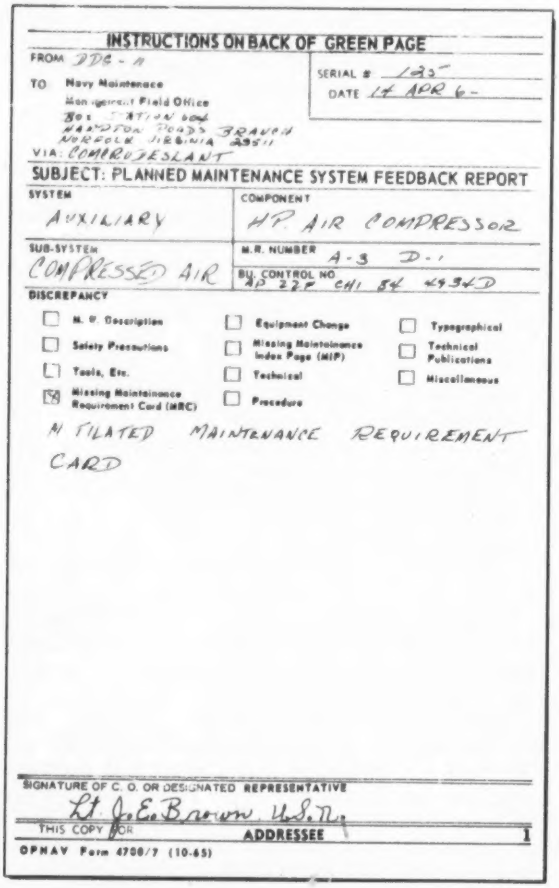
A master set of Maintenance Requirement Cards is maintained in the departmental office. This master set should be kept up to date in every respect. If a card from the working space becomes mutilated or lost, a new card can be made from the master set and used until a new card can be obtained.

PMS FEEDBACK REPORT

The PMS Feedback Report, OPNAV FORM 4700-7, is shown in figure 5-6. This form is designed to report any discrepancies or suggested improvements in the PMS as installed aboard ship. The report is to be filled out by the man who discovers the discrepancy or suggests an improvement, signed by the commanding officer or his designated representative, and mailed via the type commander to the appropriate field office listed on the reverse side of the originator's copy of the form. Atlantic Fleet ships use the Norfolk address and Pacific Fleet ships use the San Diego address.

When submitting a feedback report, be sure it is filled out completely and legibly. Handwritten copies are acceptable, but a ballpoint pen must be used to ensure that all copies are legible. Instructions for filling out the feedback report are listed on the back of the form and are discussed here for the purpose of clarification.

The "TO" line must be completed with the appropriate (San Diego or Norfolk) address. In the "FROM" line insert the hull number of the ship (DDG 11, DD 789, AD 36, etc.); and in the



INSTRUCTIONS ON BACK OF GREEN PAGE

FROM DDG - 11

TO Navy Maintenance
Management Field Office
Box STATION 606
HAMPTON ROADS BRANCH
NORFOLK VIRGINIA 23511

VIA: COMCRUDESLANT

SERIAL # 125

DATE 14 APR 6-

SUBJECT: PLANNED MAINTENANCE SYSTEM FEEDBACK REPORT

SYSTEM AUXILIARY	COMPONENT HP. AIR COMPRESSOR
SUB-SYSTEM COMPRESSED AIR	M.R. NUMBER A-3 D-1
	BU. CONTROL NO AP 22F CHI 84 4934D

DISCREPANCY

☐ M. R. Description
☐ Safety Precautions
☐ Tools, Etc.
☒ Missing Maintenance Requirement Card (MRC)
☐ Equipment Change
☐ Missing Maintenance Index Page (MIP)
☐ Technical
☐ Procedure
☐ Typographical
☐ Technical Publications
☐ Miscellaneous

M TILATED MAINTENANCE REQUIREMENT CARD

SIGNATURE OF C. O. OR DESIGNATED REPRESENTATIVE

Lt. J. E. Brown, U.S.N.

THIS COPY FOR ADDRESSEE 1

OPNAV Form 4700/7 (10-65)

40.101

Figure 5-6.—Feedback Report (OPNAV Form 4700-7).

"VIA" line indicate the type commander. The date will be the day the discrepancy is discovered or an improvement is suggested. The serial number indicates the number of feedback reports sent in by the ship.

The blocks concerning the system, subsystem, component, M.R. number, and the card control number should be filled in with information from the appropriate MIP and/or MRC. If the MRC or MIP is missing and the card control number is not available, the equipment should be identified by its name and its APL/CID or AN number. The APL/CID number identifies the parts list for the equipment and is found in the index to the Coordinated Shipboard Allowance List (COSAL). The "Technical Publications" block in the "Discrepancy" section of the report is intended to include all Naval Ship Systems Command and Naval Ordnance Systems Command publications. In the event that any of these are in error, identify the publication number, volume, revision, date, change number, page, paragraph, and/or figure.

Prior to the distribution of the report (as indicated on the original and each of the four carbon copies), check it for completeness. The discrepancy should always be explained clearly and a suggestion for its correction must always be offered.

MAINTENANCE DATA COLLECTION SUBSYSTEM

At the time of writing (1968) the Maintenance Data Collection Subsystem (MDCS) is undergoing an evaluation that may lead to substantial changes in the system. The basic purposes of the system will remain the same, but a number of details (including the MDCS forms) may change. The information given here on the MDCS should therefore be taken with some degree of caution; it will provide a general idea of the MDCS, but some details may become out of date within the near future. In general, it is considered likely that changes in the MDCS will be in the direction of requiring more data collection than is required under the present system.

The Maintenance Data Collection Subsystem (MDCS) is designed to provide a means of recording information concerning planned and corrective maintenance actions. Maintenance performed is recorded by code in sufficient detail to permit the collection of a great variety of information concerning maintenance actions and the performance of the equipment involved. The use of codes in recording and reporting maintenance actions permits machine processing with automatic data processing equipment. The system also provides data concerning the initial discovery of a malfunction, how the equipment malfunctioned, how many hours the equipment was in operation, which equipment was involved, what repair parts and materials were used, what delays were incurred, the reason for delay, and the technical specialty or work center which performed the maintenance. Each maintenance action is reported in this manner except for routine preservation actions (chipping, painting, and cleaning) and daily or weekly maintenance actions.

The shipboard installation of the Maintenance Data Collection Subsystem includes a central, functional data collection center. The primary function of the shipboard data collection center is to screen all documents for completeness and accuracy before they are forwarded to the data processing center. During the screening process, the data collection center adds a four-digit maintenance control number to each document unless the person doing the task has already received and entered a maintenance control number to obtain parts or materials from the supply department.

The effectiveness of the Maintenance Data Collection Subsystem depends initially upon the individual performing the maintenance action and the accuracy with which it is reported. Leading petty officers are responsible for ensuring that all forms used in connection with the Maintenance Data Collection Subystem are complete and accurate. Leading petty officers must also ensure that a form is submitted for each applicable action and that no action is reported more than once.

EQUIPMENT IDENTIFICATION CODE (EIC) MANUAL

It is essential that all personnel having any responsibility for maintenance actions be indoctrinated in the proper use of the Equipment Code Manual as it contains many codes used in the reporting of maintenance actions. Each major system is coded and the codes are broken down to the lowest part necessary for positive equipment identification. The manner in which the equipment identification code is obtained from the manual is described in the following example.

Assume it is desired to determine the code for the casing wearing rings and impeller wearing rings of a main condensate pump in the main steam propulsion system. By referring to the index pages (section X) of the Equipment Identification Code Manual, it is found that the MAIN PROPULSION SYSTEM, STEAM is identified by the code "Z" and the index page will be X - Z - 1 or 2. By referring to page X - Z - 1, the subsystem (in this case the feed and condensate system) is identified by the code "ZQ". The next step is to turn to the pages of the manual with the ZQ codes and go down the list of equipment until the listing for the main condensate pump is noticed. Under this listing one will find the 7-digit codes for the casing wearing rings and impeller wearing rings. The first digit of the code identifies the system, the second digit identifies the subsystem, the third and fourth digits identify the equipment, and the last three digits identify the assembly. If the assembly requires further breakdown, the last digit identifies the subassembly.

In addition to the equipment identification codes, the Equipment Identification Code Manual contains other codes and information of equal importance to the equipment identification codes. Section I of the manual contains general instructions for the preparation of forms when reporting maintenance actions. Other sections of the manual contain additional codes as follows:

Section II	Administrative Organizations
Section III	Work Centers
Section IV	How Malfunctioned
Section V	When Discovered
Section VI	Action Taken
Section VII	Service
Section VIII	Source
Section IX	Type Availability

These codes make possible the recording of a wide variety of information in a relatively small space. At the data processing level, the codes permit use of automatic data processing operations which provide pertinent direct reading information summaries. The summaries can be profitably employed only if accurate information has been recorded; therefore, familiarity with the coding system is a must and the importance of accuracy in the recording of codes must be continually stressed.

MDCS DOCUMENTATION

Documentation in the Maintenance Data Collection Subsystem is accomplished by the completion, as applicable, of one or more standard forms. Forms used to record and report information related to maintenance actions aboard ship and within repair activities include, OPNAV Form 4700-2B (Shipboard Maintenance Action), OPNAV Form 4700-2D (Deferred Action), and OPNAV Form 4700-2C (Work Request).

Shipboard Maintenance Actions

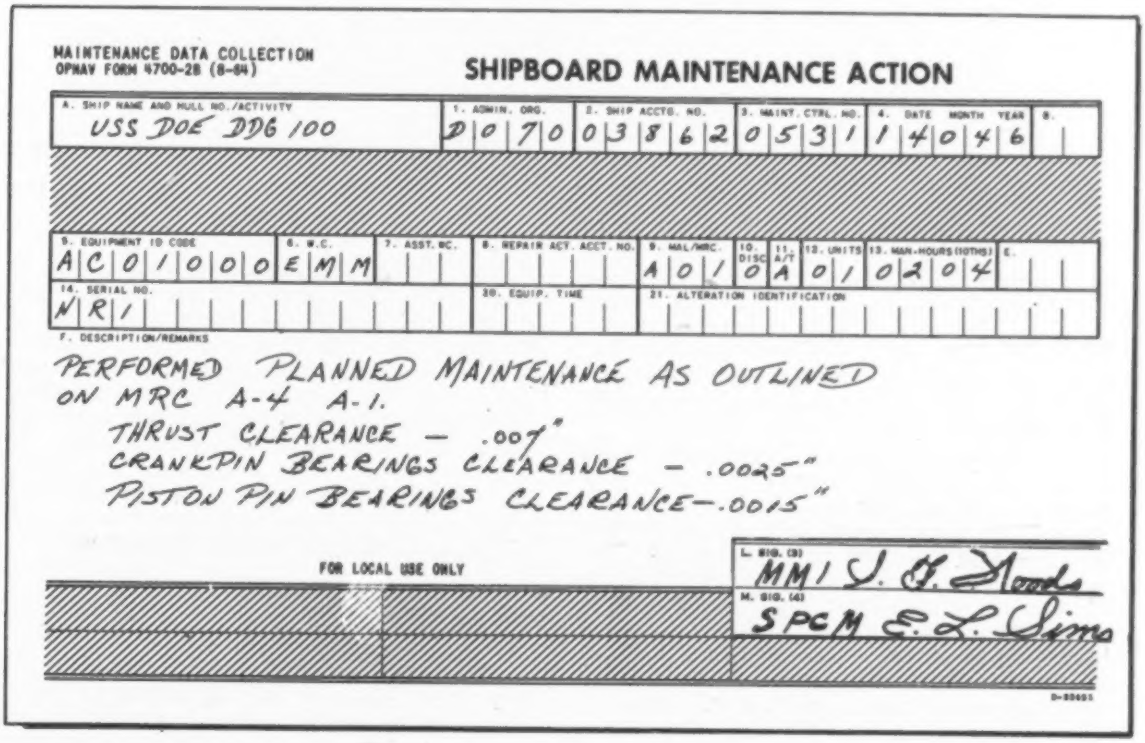
A sample Shipboard Maintenance Action (OPNAV Form 4700-2B) is shown in figure 5-7. This form is a single-sheet document used to record the completion of planned maintenance actions, corrective maintenance actions, and authorized alterations that have been performed at the shipboard level by shipboard personnel. All planned maintenance actions except daily and weekly actions must be recorded on this form. Routine preservation such as chipping, painting, and cleaning should not be reported.

The weekly schedule shown in figure 5-4 reflects that WOODS and SMITH completed maintenance requirement A-1, indicated on maintenance page A-4, on Wednesday. Figure 5-7 shows the Shipboard Maintenance Action form which WOODS completed for this maintenance requirement. Note that, in addition to giving the date (14 Apr 1966), the manhours (20.4), and the proper codes taken from the EIC Manual, WOODS has given a brief description of the maintenance performed (in block F) and has signed the form (block L). His leading petty officer has signed the form (block M) to indicate the information is complete and accurate.

The Shipboard Maintenance Action Form is also used to report work done aboard ship by an outside activity which does not report under the Maintenance Data Collection Subsystem. When a repair activity such as a civilian contractor or a shipyard (except for regular overhauls) which is not under the Maintenance Data Collection Subsystem provides ship maintenance assistance, duplicate 4700-2B documents are prepared. Block 7 of the original document is left blank and the code for the assisting work center is entered on the duplicate. Only those manhours actually spent by the shipboard personnel in assisting the outside activity are entered in block 13 of the original; manhours spent by the outside activity in assisting the shipboard work center are documented in block 13 of the duplicate.

Deferred Actions

The Deferred Action form (OPNAV 4700-2D) is a two-sheet form used to report corrective



MAINTENANCE DATA COLLECTION
OPNAV FORM 4700-2B (8-64)

SHIPBOARD MAINTENANCE ACTION

A. SHIP NAME AND HULL NO./ACTIVITY	1. ADMIN. ORG.	2. SHIP ACCTG. NO.	3. MAINT. CTRL. NO.	4. DATE MONTH YEAR	B.
USS DOE DDG 100	D070	03862	0531	14046	

5. EQUIPMENT ID CODE	6. W.C.	7. ASST. WC.	8. REPAIR ACT. ACCT. NO.	9. MAL/MRC.	10. DISC	11. A/T	12. UNITS	13. MAN-HOURS (10THS)	E.
AC010000	EMM			A01	0	A	01	0204	

14. SERIAL NO.	20. EQUIP. TIME	21. ALTERATION IDENTIFICATION
NR1		

F. DESCRIPTION/REMARKS

PERFORMED PLANNED MAINTENANCE AS OUTLINED
ON MRC A-4 A-1.
THRUST CLEARANCE — .007"
CRANKPIN BEARINGS CLEARANCE — .0025"
PISTON PIN BEARINGS CLEARANCE—.0015"

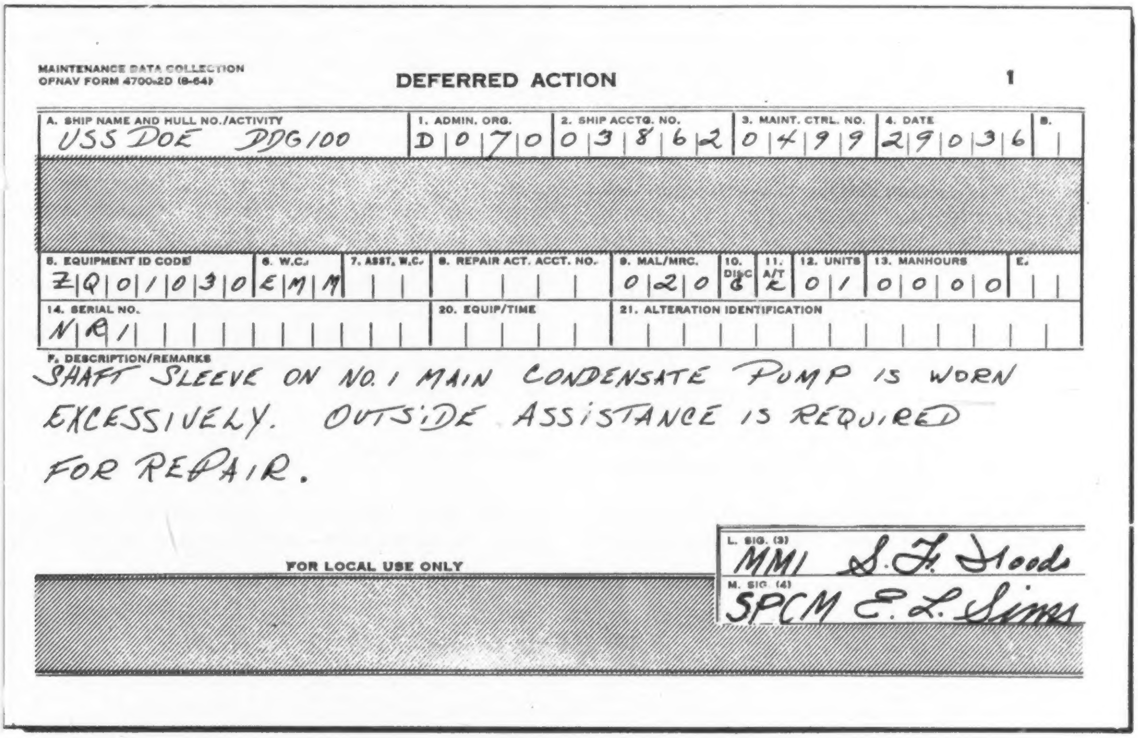
FOR LOCAL USE ONLY

L. SIG. (3) MM1 J. G. Woods

M. SIG. (4) SPCM E. L. Sims

17.81B

Figure 5-7.—Shipboard Maintenance Action Form (OPNAV Form 4700-2B).



MAINTENANCE DATA COLLECTION
OPNAV FORM 4700-2D (8-64)

DEFERRED ACTION

1

A. SHIP NAME AND HULL NO./ACTIVITY USS DOE DDG100	1. ADMIN. ORG. D070	2. SHIP ACCTG. NO. 03862	3. MAINT. CTRL. NO. 0499	4. DATE 29036	B.

5. EQUIPMENT ID CODE ZQ010030	6. W.C. EMM	7. ASST. W.C.	8. REPAIR ACT. ACCT. NO.	9. MAL/MRC. 020	10. DISC 6	11. A/T K	12. UNITS 01	13. MANHOURS 0000	E.

14. SERIAL NO. NR1	20. EQUIP/TIME	21. ALTERATION IDENTIFICATION

F. DESCRIPTION/REMARKS
SHAFT SLEEVE ON NO. 1 MAIN CONDENSATE PUMP IS WORN EXCESSIVELY. OUTSIDE ASSISTANCE IS REQUIRED FOR REPAIR.

FOR LOCAL USE ONLY

L. SIG. (3) MM1 S. F. Hoods
M. SIG. (4) SPCM E. L. Sims

17.81D

Figure 5-8.—Deferred Action Form, Sheet 1 (OPNAV Form 4700-2D).

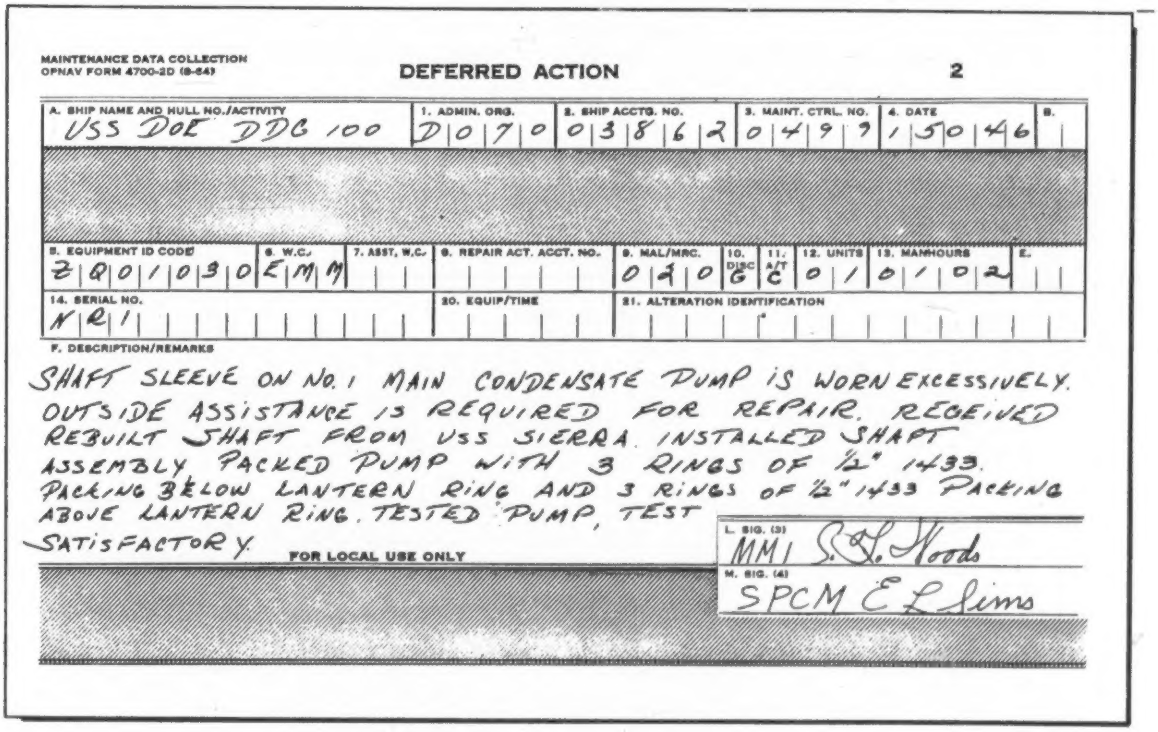
maintenance actions that are deferred because of the ship's operations, the lack of repair parts, or the requirement for outside assistance. The first sheet (fig. 5-8) is used to record and report the reason for deferral and the second sheet (fig. 5-9) is used to report the completion of the deferred action.

If a corrective maintenance action is beyond ship's force capability and outside assistance is required, a work request is prepared and forwarded. This situation will always require that an OPNAV Form 4700-2D be submitted. The manhours that have been expended by ship's force in connection with the maintenance action, even if they consist of only the time required to fill out the form, are documented on the OPNAV Form 4700-2D. The manhours involved in the investigation and the removal of the equipment are documented on the first sheet of the form. The manhours involved in the reinstallation of the equipment are documented on the second sheet when the task is completed.

If a shipboard maintenance action must be deferred due to the lack of necessary repair parts or because of the ship's operations, an OPNAV Form 4700-2D is prepared and the first sheet is submitted using the appropriate action taken code from section VI of the Equipment Identification Code Manual and the manhours expended are entered in block 13. When the maintenance action is completed, the second sheet is submitted using the appropriate action taken code and the manhours expended in completing the action are entered in block 13.

Work Requests

The Work Request (OPNAV 4700-2C) is a four-sheet document (fig. 5-10) which is presently used to request outside assistance from repair ships and tenders. Part II of the work request, also a four-sheet form shown in figure 5-11, is a continuation of the basic form; part



MAINTENANCE DATA COLLECTION
OPNAV FORM 4700-2D (8-64)

DEFERRED ACTION 2

A. SHIP NAME AND HULL NO./ACTIVITY	1. ADMIN. ORG.	2. SHIP ACCTG. NO.	3. MAINT. CTRL. NO.	4. DATE	B.
USS DOE DDG 100	D070	03862	0499	15046	

5. EQUIPMENT ID CODE	6. W.C.	7. ASST. W.C.	8. REPAIR ACT. ACCT. NO.	9. MAL/MRC.	10. DISC	11. A/T	12. UNITS	13. MANHOURS	E.
ZQ01030	EMM			020	G	C	01	0102	

14. SERIAL NO.	20. EQUIP/TIME	21. ALTERATION IDENTIFICATION
NR1		

F. DESCRIPTION/REMARKS

SHAFT SLEEVE ON NO. 1 MAIN CONDENSATE PUMP IS WORN EXCESSIVELY. OUTSIDE ASSISTANCE IS REQUIRED FOR REPAIR. RECEIVED REBUILT SHAFT FROM USS SIERRA. INSTALLED SHAFT ASSEMBLY. PACKED PUMP WITH 3 RINGS OF ½" 1433. PACKING BELOW LANTERN RING AND 3 RINGS OF ½" 1433 PACKING ABOVE LANTERN RING. TESTED PUMP, TEST SATISFACTORY.

L. SIG. (3) MM1 S. L. Woods

M. SIG. (4) SPCM E L Sims

FOR LOCAL USE ONLY

17.81D

Figure 5-9.—Deferred Action Form, Sheet 2.

II provides additional space for written descriptions, diagrams, or sketches.

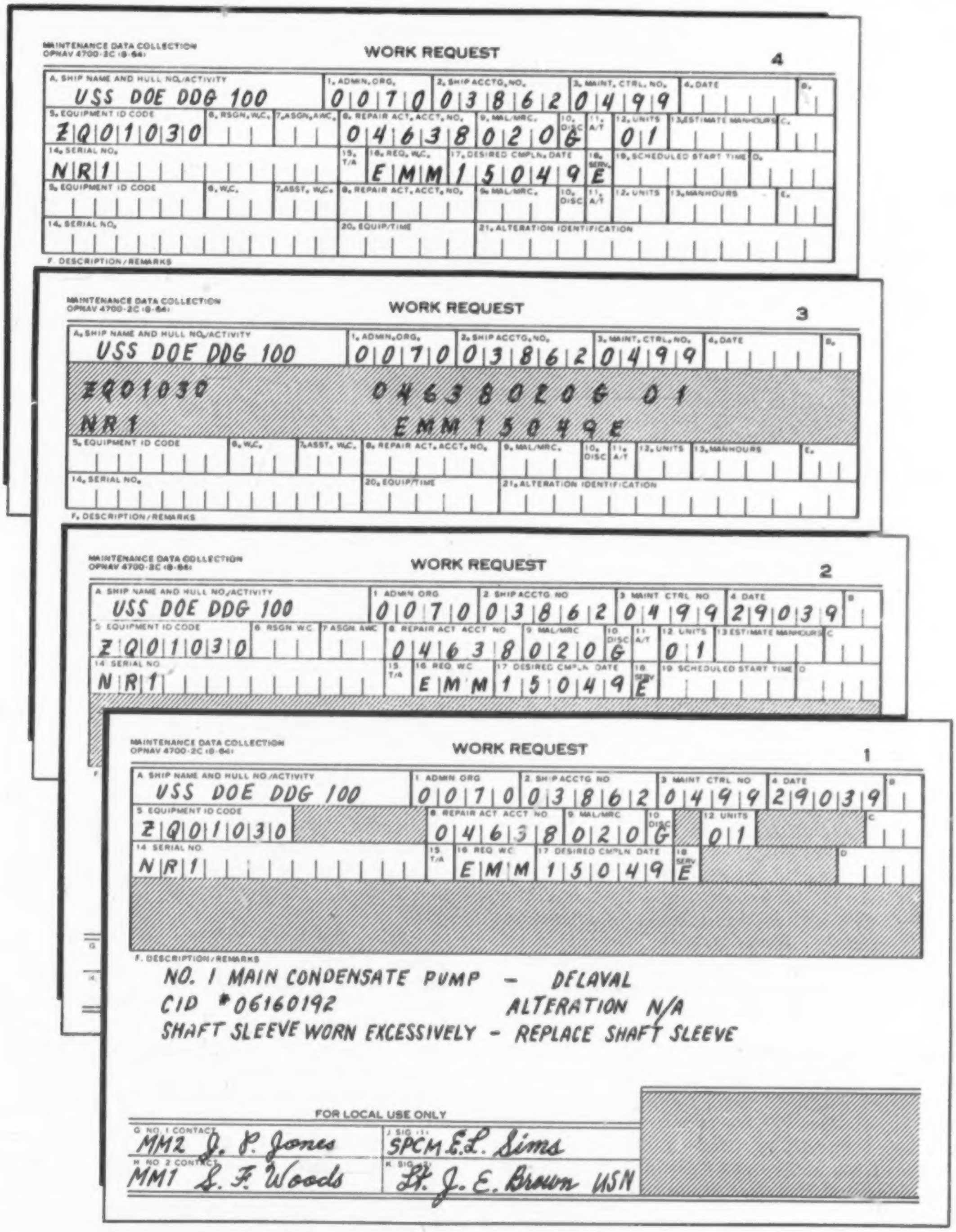
The information to be given in block F (Description/Remarks) of the work request includes the name of the component, the CID/AN number of the component, and the alteration number. If the alteration number is not applicable, it must be listed as N/A. Block F should also contain a description of the existing defects, the repairs required on the component and all other information as required by the Type Command.

The signature blocks G, H, and J are to be signed by three leading petty officers, one from each duty section, who are familiar with the work to be done by the repair activity. Signature block K will be used by the commanding officer or his authorized representative to indicate command approval of the request for repair assistance.

Sheet 1 of the work request is retained by the requesting activity and sheets 2, 3, and 4 are forwarded to the assigned repair activity via the designated chain of command. Information concerning the administrative procedures to be taken on a work request by repair activities may be found in chapter 4 of the Maintenance and Material Management (3-M) Manual, OPNAV 43P2.

When the work request is accepted by the repair activity, sheet 3 of the document is used as a job order and is sent to the assigned work center. Prepunched Work Supplement Cards (OPNAV 4700-2F) are also sent to the assigned work center. A sample OPNAV 4700-2F is shown in figure 5-12.

The assigned work center performs the job, records the maintenance data on the Work Supplement Cards, and records the material obtained outside of normal supply channels on the reverse side of the card. If more than one work day is required to complete the action, or if assisting work centers are needed, the lead work center will utilize the additional Work



MAINTENANCE DATA COLLECTION
OPNAV 4700-2C (8-64)

WORK REQUEST 4

A. SHIP NAME AND HULL NO./ACTIVITY: USS DOE DDG 100
1. ADMIN. ORG.: 0070
2. SHIP ACCTG. NO.: 03862
3. MAINT. CTRL. NO.: 0499
4. DATE:
5. EQUIPMENT ID CODE: ZQ01030
8. REPAIR ACT. ACCT. NO.: 04638
9. MAL/MRC.: 020
10. DISC: G
12. UNITS: 01
14. SERIAL NO.: NR1
16. REQ. W.C.: EMM
17. DESIRED CMPLN. DATE: 15049
18. SERV.: E

MAINTENANCE DATA COLLECTION
OPNAV 4700-2C (8-64)

WORK REQUEST 3

A. SHIP NAME AND HULL NO./ACTIVITY: USS DOE DDG 100
1. ADMIN. ORG.: 0070
2. SHIP ACCTG. NO.: 03862
3. MAINT. CTRL. NO.: 0499
4. DATE:

ZQ01030 04638020G 01
NR1 EMM15049E

MAINTENANCE DATA COLLECTION
OPNAV 4700-2C (8-64)

WORK REQUEST 2

A. SHIP NAME AND HULL NO./ACTIVITY: USS DOE DDG 100
1. ADMIN ORG: 0070
2. SHIP ACCTG NO: 03862
3. MAINT CTRL NO: 0499
4. DATE: 29039
5. EQUIPMENT ID CODE: ZQ01030
8. REPAIR ACT ACCT NO: 04638
9. MAL/MRC: 020
10. DISC: G
12. UNITS: 01
14. SERIAL NO: NR1
16. REQ W.C.: EMM
17. DESIRED CMPLN DATE: 15049
18. SERV: E

MAINTENANCE DATA COLLECTION
OPNAV 4700-2C (8-64)

WORK REQUEST 1

A. SHIP NAME AND HULL NO./ACTIVITY: USS DOE DDG 100
1. ADMIN ORG: 0070
2. SHIP ACCTG NO: 03862
3. MAINT CTRL NO: 0499
4. DATE: 29039
5. EQUIPMENT ID CODE: ZQ01030
8. REPAIR ACT ACCT NO: 04638
9. MAL/MRC: 020
10. DISC: G
12. UNITS: 01
14. SERIAL NO: NR1
16. REQ WC: EMM
17. DESIRED CMPLN DATE: 15049
18. SERV: E

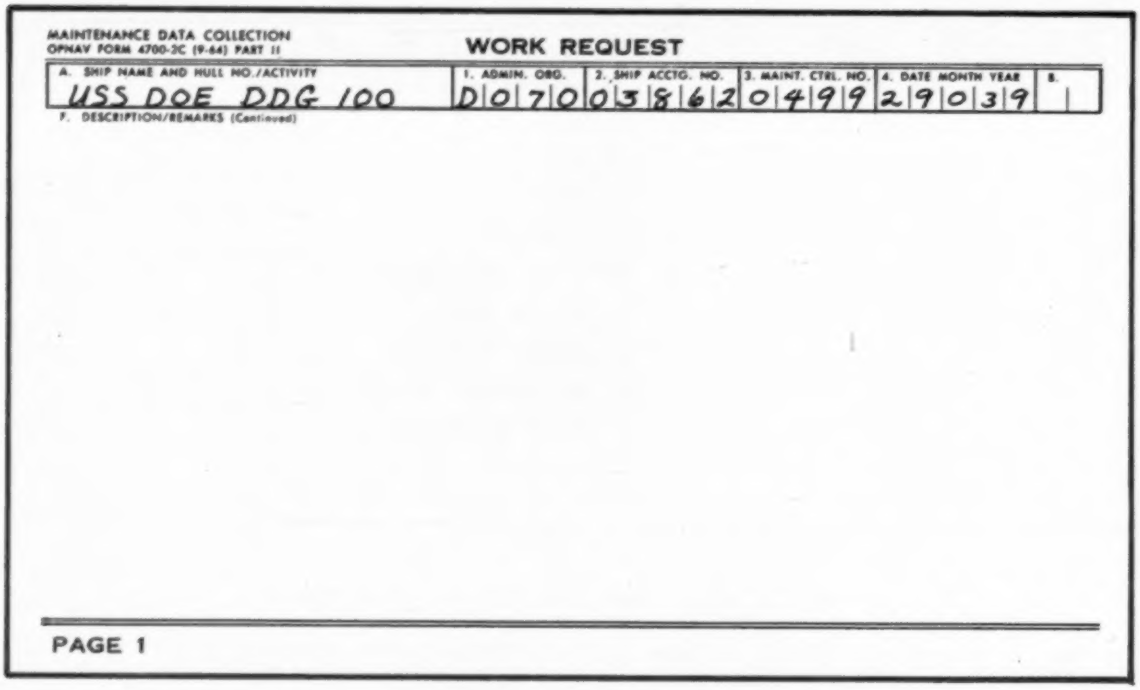
F. DESCRIPTION/REMARKS
NO. 1 MAIN CONDENSATE PUMP - DELAVAL
CID #06160192 ALTERATION N/A
SHAFT SLEEVE WORN EXCESSIVELY - REPLACE SHAFT SLEEVE

FOR LOCAL USE ONLY
G. NO. 1 CONTACT: MM2 J. P. Jones
J. SIG (1): SPCM E.L. Sims
H. NO. 2 CONTACT: MM1 S. F. Woods
K. SIG (2): Lt. J. E. Brown USN

17.81C

Figure 5-10.—Work Request (OPNAV Form 4700-2C).

94



MAINTENANCE DATA COLLECTION
OPNAV FORM 4700-2C (9-64) PART II

WORK REQUEST

A. SHIP NAME AND HULL NO./ACTIVITY	1. ADMIN. ORG.	2. SHIP ACCTG. NO.	3. MAINT. CTRL. NO.	4. DATE MONTH YEAR	5.
USS DOE DDG 100	D070	03862	0499	29039	

F. DESCRIPTION/REMARKS (Continued)

PAGE 1

17.81C

Figure 5-11.—Work Request (OPNAV Form 4700-2C, Part II).

Supplement Cards provided to record daily manhours expended. (The lead work center is that work center which has the primary responsibility for the completion of the task described on the work request.)

When a repair job is completed, sheet 3 of the work request is completed by the lead work center and is signed by the man who performed the maintenance. An inspector from the requesting activity is contacted for final inspection and signs off the work request. After obtaining the signature of the inspector, the lead work center supervisor forwards the completed work request to his division officer.

After the repaired part is received from the repair activity and installed, the carbon (sheet 2) of the Deferred Action form (fig. 5-9) is completed by inserting the date of completion in block 4, a new action taken code in block 11, the additional manhours in block 13, and appropriate remarks in block F. The form is then signed by the man doing the work and by his supervisor, and is then submitted to the data processing center.

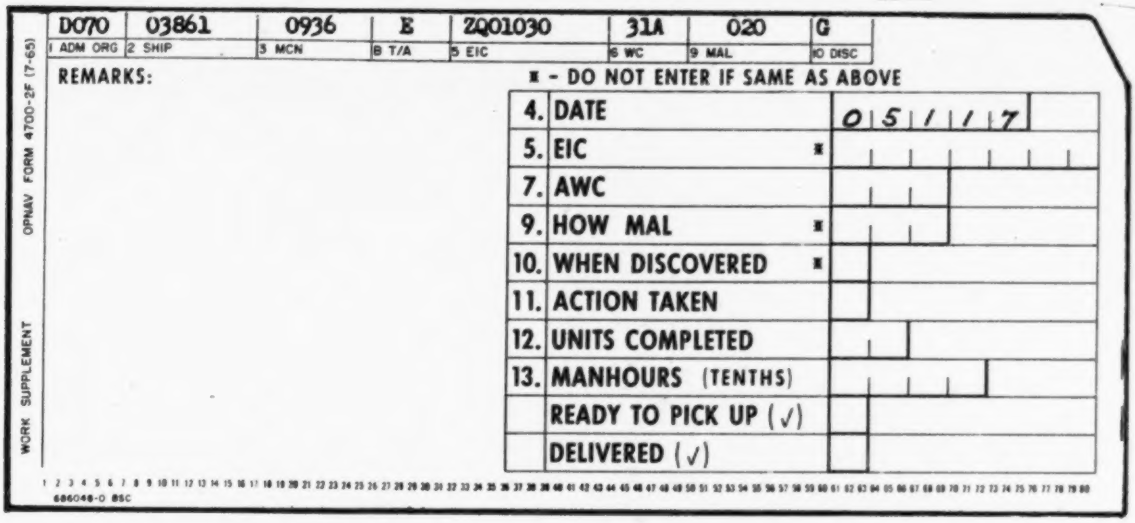
Entries on Forms, OPNAV 4700 Series

Detailed descriptions of the entries to be made on MDCS forms (Shipboard Maintenance Action, Work Request, and Deferred Action) are listed in the EIC Manual and in chapter 3 of the 3-M Manual (OPNAV 43P2). Brief descriptions of these entries are given in the paragraphs which follow. (Refer to fig. 5-7.)

Block A, Ship Name and Hull No./ Activity: Enter the name and hull number of the ship—for example, USS Doe (DDG 100).

Block 1, Administrative Organization: Enter the 4-letter/number code (from section II of the EIC Manual) to which the ship is assigned. If the ship is assigned to DESRON 7, for example, DO7O is entered.

Block 2, Ship Accounting Number (now called Unit Identification Code, UIC): Enter the UIC



WORK SUPPLEMENT OPNAV FORM 4700-2F (7-65)

D070	03861	0936	E	ZQ01030	31A	020	G
1 ADM ORG	2 SHIP	3 MCN	B T/A	5 EIC	6 WC	9 MAL	10 DISC

REMARKS:

* - DO NOT ENTER IF SAME AS ABOVE

4.	DATE	0 5 1 1 7
5.	EIC *	
7.	AWC	
9.	HOW MAL *	
10.	WHEN DISCOVERED *	
11.	ACTION TAKEN	
12.	UNITS COMPLETED	
13.	MANHOURS (TENTHS)	
	READY TO PICK UP (✓)	
	DELIVERED (✓)	

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

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17.81F

Figure 5-12.—Work Supplement (OPNAV FORM 4700-2F).

number for the ship or activity for which the maintenance was performed. This entry is obtained from the NAVCOMPT Manual, Volume 2, chapter 5, or from the supply department.

Block 3, Maintenance Control Number: This number is used to relate all documents submitted on a specific job. The number is filled in by the maintenance control section of the ship before the documents leave the ship. The numbers will be assigned consecutively, beginning with 0001 and ending at 9999. Upon reaching 9999, the series will be started again at 0001.

Block 4, Date: Enter the day, month, and year the maintenance is accomplished; or, for a work request, enter the date the request is submitted.

Block B, Type Availability: This block is left blank on all forms except the Work Request, OPNAV Form 4700-2C. On the work request, this block will be filled in with a single-letter code, taken from section IX of the EIC Manual, to identify the type of availability in which the repair activity will perform the maintenance.

Block 5, Equipment Identification Code: Enter, from section X of the EIC Manual, the appropriate 7-letter/number code which identifies the system, subsystem, component, or part, whichever is the lowest designated assembly on which maintenance is requested or performed. Caution must be exercised to ensure that the EIC number correctly identifies the exact item on which maintenance is requested or performed.

Block 6, Work Center: Enter the 3-letter/number code from section III of the EIC Manual which identifies the department, rating, shop, or group which performs the maintenance actions on the equipment identified in the equipment identification code, block 5.

Block 7, Assisting Work Center: Leave blank. When information is required in this block it will be filled out by the supervisor in accordance with the EIC Manual and chapter 3 of the 3-M Manual.

Block 8, Repair Activity Accounting Number (now called Unit Identification Code, UIC): This blank will be filled in by the repair activity designated by the type commander.

Block 9, How Mal/MRC: If the action is a result of a malfunction, list the 3-digit code from section IV of the EIC Manual which best describes the trouble. If the action is a result of planned maintenance (MRC), enter a 3-letter/number combination code which identifies the frequency check on the equipment. For example, if the situation is an M-1 PMS action enter M01.

Block 10, Discovered: Enter the appropriate code from section V of the EIC Manual which identifies the time the maintenance requirement was discovered.

Block 11, Action Taken: Enter the code from section VI of the EIC Manual which best describes the maintenance action taken. "Not Repairable This Ship" (NRTS) codes will be used only by the repair activities.

Block 12, Units: Enter the number of identical items, identified in block 5, on which the same maintenance action was attempted, performed, or requested. If identical alterations or significant maintenance actions are accomplished on identical equipment bearing different serial numbers, each equipment will be reported on a separate document.

Block 13, Manhours: On completion of the maintenance action, enter the total manhours (to the nearest tenth) expended by all shipboard personnel. If the task was completed in 1 1/2 hours, for example, "0015" is entered. Enter an "O" in any space not used.

Block C (fig. 5-10), Blank: Leave blank.

Block 14, Serial Number: For detailed information on completing this particular block, see chapter 3 of the 3-M Manual. For mechanical/electrical equipment, the serial number is not required; instead, the shipboard numbering identification system will be used, followed by the abbreviated name of the equipment. For example, if block 5 identified a main feed pump, and the pump in question is number 1, block 14 should contain the entry "NR 1 MNFDPMP."

Block 15, T/A: Leave blank.

Block 16, Requesting Work Center: Enter the letter/number code that identifies the department, rating, shop, or group that is requesting assistance from the repair activity. Work center codes may be found in section III of the EIC Manual.

Block 17, Desired Completion Date: Enter the 5-number code that identifies the day, month, and year that the outside repair activity must complete maintenance in order for the requesting activity to meet its operational commitments. If this date were 9 March 1966, for example, the 5-number code 09036 would be entered.

Block 18, Service: Enter the single-letter code from section VII of the EIC Manual which identifies the type of assistance the requesting ship will furnish the repair activity in completing the requested maintenance.

Block 19, Scheduled Start Date: This entry, which is for repair activities only, is the estimated starting date of the requested maintenance.

Block D, Blank: Leave blank.

Blocks E and 20, Equipment Downtime and Equipment Operating Time: These entries are required only for equipment identified by green pages in the EIC Manual. Detailed instructions for these blocks may be found in section I of the EIC Manual and chapter 3 of the 3-M Manual.

Block 21, Alteration Identification: If an alteration is to be accomplished, this block will contain the alteration identification from the authorization directive.

The information contained in blocks A, 1 and 2 of OPNAV Forms 4700-2B, 4700-2C, and 4700-2D will be identical on all forms for any particular ship; if desired, this information may be preprinted in by the ship. Each maintenance action is assigned its own unique maintenance control number; if a maintenance task requires more than one form, as in the example using figures 5-8 through 5-10, the numbers will be identical.

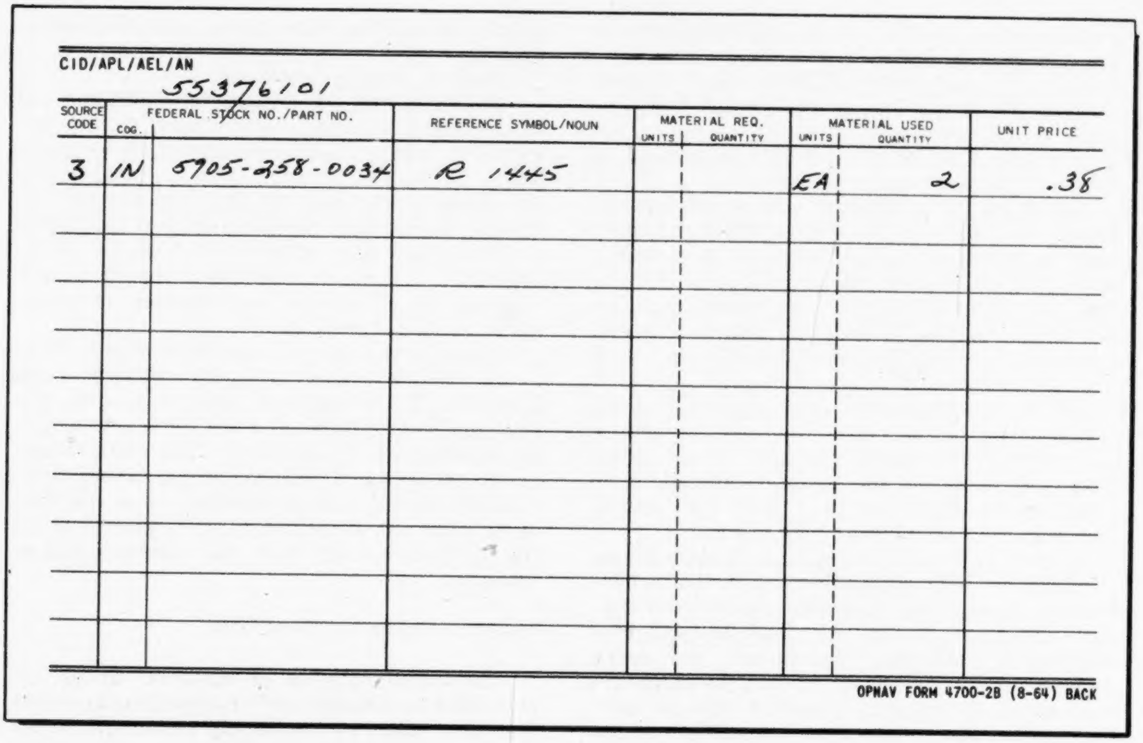
Material Usage and Cost Data

The documentation of material usage and cost data on maintenance transactions requires the joint effort of the supply and maintenance personnel on board ship. Economy of effort and the elimination of duplicate recording are highly desirable.

Any time that repair parts or materials are drawn from the supply department for shipboard maintenance, the prescribed form must be used to request the materials. Maintenance personnel are required to furnish the work center code and the lowest possible EIC taken from the EIC Manual, the CID number, the maintenance control number, the name of the part, the quantity required, and the stock number when submitting this form to the supply department. The supply personnel will then complete the form. If the ship does not have data processing equipment aboard, NAVSUP Form 1250 is used, and cost is documented from that form. If the ship has data processing equipment, a DD Form 1348 is used.

When the material to support a maintenance action is obtained from outside the normal supply channels or from pre-expended material bins, the reverse side of the appropriate OPNAV 4700 is used. The reverse sides of OPNAV 4700 series forms are essentially the same. The reverse side of OPNAV Form 4700-2B is shown

97



CID/APL/AEL/AN
55376101

SOURCE CODE	COG.	FEDERAL STOCK NO./PART NO.	REFERENCE SYMBOL/NOUN	MATERIAL REQ. UNITS	MATERIAL REQ. QUANTITY	MATERIAL USED UNITS	MATERIAL USED QUANTITY	UNIT PRICE
3	IN	5905-258-0034	R 1445			EA	2	.38

OPNAV FORM 4700-2B (8-64) BACK

17.81B

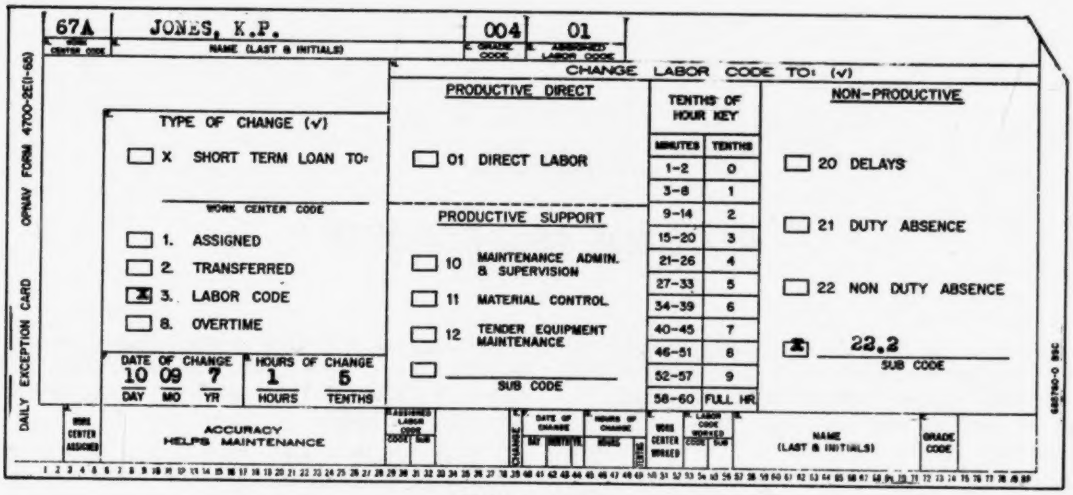
Figure 5-13.—Reverse side of OPNAV Form 4700-2B.

in figure 5-13. On this side of the form, when appropriate, the following information is entered; the CID number, the source code taken from section VIII of the EIC Manual, the cognizance symbol taken from supply publications to identify the supply account and the inventory manager of the item used, the Federal Stock Number, the reference symbol taken from circuit diagrams or the name of the part being replaced, the unit of issue of the material used, the quantity used, and the unit cost of the item.

MANHOUR ACCOUNTING SYSTEM

The Manhour Accounting System, sometimes referred to as Exception Time Accounting (ETA), is designed and intended for use by the repair department of a repair activity in conjunction with the Maintenance Data Collection Subsystem. It is basically a management tool and accounts for deviations from a normal seven-hour working day.

Exception Time Accounting includes the use of codes, the preparation of a Master Roster Listing, and the preparation and submission of Daily Exception Cards (OPNAV Form 4700-2E). A sample Daily Exception Card is shown in figure 5-14. Detailed procedures for the use of the card may be found in chapter 5 of the Maintenance and Material Management (3-M) Manual, OPNAV 43P2.



DAILY EXCEPTION CARD OPNAV FORM 4700-2E(1-68)

67A	JONES, K.P.	004	01
WORK CENTER CODE	NAME (LAST & INITIALS)	GRADE CODE	ASSIGNED LABOR CODE

TYPE OF CHANGE (✓)

☐ X SHORT TERM LOAN TO: ____________ WORK CENTER CODE

☐ 1. ASSIGNED

☐ 2. TRANSFERRED

☒ 3. LABOR CODE

☐ 8. OVERTIME

DATE OF CHANGE: 10 DAY 09 MO 7 YR

HOURS OF CHANGE: 1 HOURS 5 TENTHS

CHANGE LABOR CODE TO: (✓)

PRODUCTIVE DIRECT

☐ 01 DIRECT LABOR

PRODUCTIVE SUPPORT

☐ 10 MAINTENANCE ADMIN. & SUPERVISION

☐ 11 MATERIAL CONTROL

☐ 12 TENDER EQUIPMENT MAINTENANCE

☐ ____________ SUB CODE

TENTHS OF HOUR KEY

MINUTES	TENTHS
1-2	0
3-8	1
9-14	2
15-20	3
21-26	4
27-33	5
34-39	6
40-45	7
46-51	8
52-57	9
58-60	FULL HR

NON-PRODUCTIVE

☐ 20 DELAYS

☐ 21 DUTY ABSENCE

☐ 22 NON DUTY ABSENCE

☒ 22.2 SUB CODE

WORK CENTER ASSIGNED	ACCURACY HELPS MAINTENANCE	ASSIGNED LABOR CODE CODE SUB		CHANGE	DATE OF CHANGE DAY MONTH YR	HOURS OF CHANGE HOURS TENTHS	WORK CENTER WORKED	LABOR CODE WORKED CODE SUB	NAME (LAST & INITIALS)	GRADE CODE

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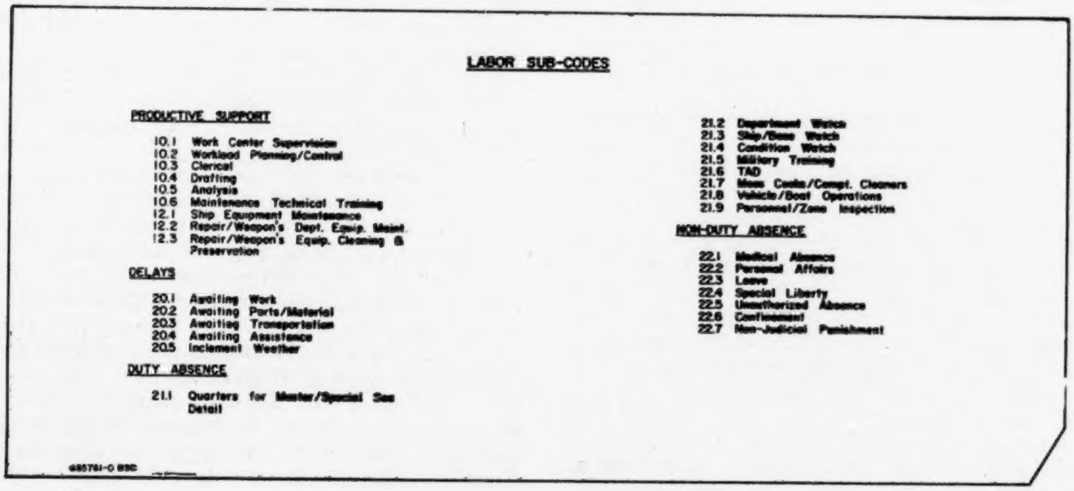
FRONT SIDE



LABOR SUB-CODES

PRODUCTIVE SUPPORT

10.1 Work Center Supervision
10.2 Workload Planning/Control
10.3 Clerical
10.4 Drafting
10.5 Analysis
10.6 Maintenance Technical Training
12.1 Ship Equipment Maintenance
12.2 Repair/Weapon's Dept. Equip. Maint.
12.3 Repair/Weapon's Equip. Cleaning & Preservation

DELAYS

20.1 Awaiting Work
20.2 Awaiting Parts/Material
20.3 Awaiting Transportation
20.4 Awaiting Assistance
20.5 Inclement Weather

DUTY ABSENCE

21.1 Quarters for Muster/Special Sea Detail
21.2 Department Watch
21.3 Ship/Base Watch
21.4 Condition Watch
21.5 Military Training
21.6 TAD
21.7 Mess Cooks/Compt. Cleaners
21.8 Vehicle/Boat Operations
21.9 Personnel/Zone Inspection

NON-DUTY ABSENCE

22.1 Medical Absence
22.2 Personal Affairs
22.3 Leave
22.4 Special Liberty
22.5 Unauthorized Absence
22.6 Confinement
22.7 Non-Judicial Punishment

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REVERSE SIDE

17.81E

Figure 5-14.—OPNAV Form 4700-2E.

CHAPTER 6

RECORDS AND REPORTS

Accurate, legible, and up-to-date engineering records plus the timely submission of accurate and legible reports reflect efficient administration of the engineering department. Records maintained by the engineering department and reports submitted to the engineer officer provide the data for engineering reports to higher authority. Perusal of reliable records and reports by the engineer officer affords him an easy and effective method of keeping informed of the state of material and performance in all parts of the department.

The type commander, as coordinator of administrative matters for ships assigned, issues the necessary directives to regulate administrative records and reports required of ships within the command. The directives generally include a list of the records to be maintained by ships of the type and a list of recurring reports (in accordance with the current revision of OpNav Instruction 5213.7) required by other commands and agencies of the Navy. With this information, the commanding officer can establish a system for maintaining current and accurate records and for forwarding reports in a correct and timely fashion. Instructions for the disposal of shipboard records are published in Part III of Disposal of Navy and Marine Corps Records, SecNavInst P5212.5B.

Proper administration of the engineering records and reports system requires the regular and conscientious attention of the engineer officer and that he have knowledge of the material to be recorded or reported. A record reference file containing complete information on the methods of maintaining required records and a report tickler file are invaluable administrative aids to the engineer officer. The record reference file should contain indicator separators marked alphabetically. Record reference cards should be filed alphabetically by subject. The report tickler file cards may be arranged in order of the occurrence of the report (daily, weekly, monthly, etc.). The Recurring Reports Records form, NavExos 4179 (a 5" X 8" card), may be used for both files.

There is no simple way to ensure the accuracy of records and reports. First, the responsibility for keeping the records and preparing the reports must be established within the department and then the duty of checking and verifying the data contained therein must be assigned. The engineering department and division organization manuals provide excellent means of fixing departmental recordkeeping responsibilities. The department training program should provide for the familiarization of engineering personnel with the proper procedures for obtaining data and maintaining records.

Some engineering records are mandatory (required by law) while others are virtually indispensable for efficient operation of the engineering plant. The records and reports that are basic to a well-administered engineering department of any large ship are discussed in this chapter and in other chapters (Training Records, Chapter 4; Planned Maintenance Records, Chapter 5; and Trial and Inspection Reports, Chapter 8) of this publication. (The special records and reports used in connection with the 3-M System are discussed in chapter 5 of this publication.)

The standard forms used as illustrations in this publication are prepared by the various bureaus and CNO. The forms are for issue to forces afloat and can be obtained as indicated in the Navy Stock List of Forms and Publications, NavSup 2002. The forms are revised as conditions warrant; personnel ordering new forms must exercise care to obtain current forms. When complementary forms are necessary for local use, make certain that an existing standard form will not serve the purpose

100

before having complentary forms prepared and printed.

The engineer officer will be assigned the task of preparing (for submission to higher authority) the ship's operational reports dealing principally with engineering matters. The engineer officer should refer to directives of appropriate fleet and other operational commanders for requirements (frequency, format, and time of submission) of specific operational reports. Operational Reports, NWIP 10-1 (revised), summarizes for easy reference the operational reports required by CNO and the reports most commonly required by fleet and other operational commanders.

LEGAL RECORDS

The Engineering Log (NavShips 117) and the Engineer's Bell Book (NavShips 116) are legal records of the engineering department. Completed Engineering Log and Engineer's Bell Book sheets are preserved on board as permanent records except in obedience to a demand from a Navy Court or Board, or from the Navy Department. If it is necessary for these records or any portions thereof to be removed from the ship, a photostatic copy of the material to be removed is prepared for the ship's files and certified as a true copy by the engineer officer. Completed Engineering Log and Bell Book sheets may be destroyed 3 years after the date of the last entries. Current Engineering Log and Bell Book sheets are forwarded to the nearest Naval Records Management Center when a ship is stricken from the list of naval ships. Sheets less than 3 years old (at time of inactivation) are retained on board when a ship is placed in inactive status.

ENGINEERING LOG

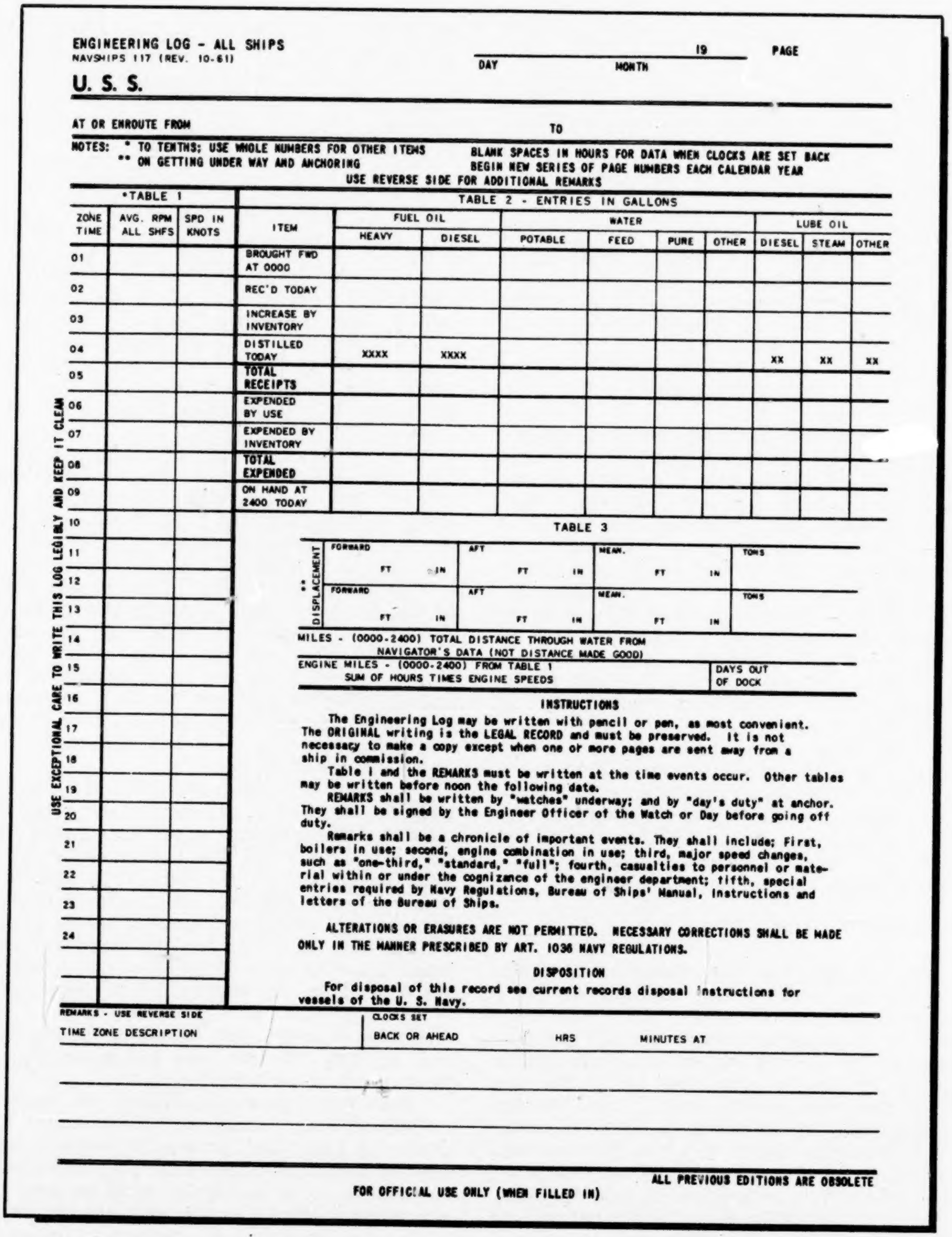
The Engineering Log, NavShips 117 (fig. 6-1) together with the Log Continuation Sheet, NavShips 117A, is a complete daily record, by watches, of important events and data pertaining to the engineering department and the operation of the ship's propulsion plant. The log must show the average hourly rpm (to the nearest tenth) for all shafts; the speed in knots; the total engine miles steamed for the day; all major speed changes; draft and displacement upon getting underway and anchoring; fuel, water, and lubricating oil on hand, received, and expended; the disposition of the engines, boilers, and principal auxiliaries, and any changes in their disposition; any injuries to engineering department personnel; any casualties to engineering department machinery, equipment, or material; and such other matters as may be specified by competent authority.

Entries in the Engineering Log must be made in accordance with instructions given (1) on the log sheet (NavShips 117), (2) in chapter 10 of U. S. Navy Regulations, (3) in chapter 9004(6) of NavShips Technical Manual, and (4) in directives issued by the type commander. Each entry must be a complete statement and employ standard phraseology. The type commander's directives contain other specific requirements pertaining to the remarks section of Engineering Logs for ships of the type; the engineer officer must ensure compliance with these directives.

The original Engineering Log, prepared neatly and legibly in ink or pencil, is the legal record. The remarks should be prepared—and must be signed—by the engineering officer of the watch (underway) or the engineering department duty officer (in port). No erasures are permitted in the log. When a correction is deemed necessary, a single line is drawn through the original entry so that the entry remains legible and the correct entry is inserted in such a manner as to ensure clarity and legibility. Corrections, additions, or changes are made only by the person required to sign the log for the watch and are initialed by him on the margin of the page.

The engineer officer verifies the accuracy and completeness of all entries and signs the log daily. The commanding officer approves the log and signs it on the last calendar day of each month and on the date he relinquishes command. The engineer officer should require that the log sheets be submitted to him in sufficient time to allow him to check and sign them prior to noon of the first day following the date of the log sheet(s). Completed pages of the log, filed in a post-type binder, are numbered consecutively, beginning with the first day of each calendar year and going through the last day of the calendar year.

When the commanding officer (or engineer officer) directs a change or addition to the Engineering Log, the person concerned must comply unless he believes the proposed change or addition to be incorrect; in which event the commanding officer (or engineer officer) enters such remarks over his signature as he deems



ENGINEERING LOG - ALL SHIPS
NAVSHIPS 117 (REV. 10-61)

U. S. S.

DAY MONTH 19 PAGE

AT OR ENROUTE FROM TO

NOTES: * TO TENTHS; USE WHOLE NUMBERS FOR OTHER ITEMS
** ON GETTING UNDER WAY AND ANCHORING

BLANK SPACES IN HOURS FOR DATA WHEN CLOCKS ARE SET BACK
BEGIN NEW SERIES OF PAGE NUMBERS EACH CALENDAR YEAR
USE REVERSE SIDE FOR ADDITIONAL REMARKS

USE EXCEPTIONAL CARE TO WRITE THIS LOG LEGIBLY AND KEEP IT CLEAN

*TABLE 1

ZONE TIME	AVG. RPM ALL SHFS	SPD IN KNOTS
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

TABLE 2 - ENTRIES IN GALLONS

ITEM	FUEL OIL		WATER				LUBE OIL		
	HEAVY	DIESEL	POTABLE	FEED	PURE	OTHER	DIESEL	STEAM	OTHER
BROUGHT FWD AT 0000									
REC'D TODAY									
INCREASE BY INVENTORY									
DISTILLED TODAY	XXXX	XXXX					XX	XX	XX
TOTAL RECEIPTS									
EXPENDED BY USE									
EXPENDED BY INVENTORY									
TOTAL EXPENDED									
ON HAND AT 2400 TODAY									

TABLE 3

** DISPLACEMENT	FORWARD FT IN	AFT FT IN	MEAN. FT IN	TONS
	FORWARD FT IN	AFT FT IN	MEAN. FT IN	TONS

MILES - (0000-2400) TOTAL DISTANCE THROUGH WATER FROM NAVIGATOR'S DATA (NOT DISTANCE MADE GOOD)

ENGINE MILES - (0000-2400) FROM TABLE 1 SUM OF HOURS TIMES ENGINE SPEEDS

DAYS OUT OF DOCK

INSTRUCTIONS

The Engineering Log may be written with pencil or pen, as most convenient. The ORIGINAL writing is the LEGAL RECORD and must be preserved. It is not necessacy to make a copy except when one or more pages are sent away from a ship in commission.

Table I and the REMARKS must be written at the time events occur. Other tables may be written before noon the following date.

REMARKS shall be written by "watches" underway; and by "day's duty" at anchor. They shall be signed by the Engineer Officer of the Watch or Day before going off duty.

Remarks shall be a chronicle of important events. They shall include; First, boilers in use; second, engine combination in use; third, major speed changes, such as "one-third," "standard," "full"; fourth, casualties to personnel or material within or under the cognizance of the engineer department; fifth, special entries required by Navy Regulations, Bureau of Ships' Manual, Instructions and letters of the Bureau of Ships.

ALTERATIONS OR ERASURES ARE NOT PERMITTED. NECESSARY CORRECTIONS SHALL BE MADE ONLY IN THE MANNER PRESCRIBED BY ART. 1036 NAVY REGULATIONS.

DISPOSITION

For disposal of this record see current records disposal instructions for vessels of the U. S. Navy.

REMARKS - USE REVERSE SIDE

TIME ZONE DESCRIPTION

CLOCKS SET
BACK OR AHEAD HRS MINUTES AT

ALL PREVIOUS EDITIONS ARE OBSOLETE

FOR OFFICIAL USE ONLY (WHEN FILLED IN)

98.162

Figure 6-1.—Engineering Log.

appropriate. After the log has been signed by the commanding officer, no change is permitted without his permission or direction.

ENGINEER'S BELL BOOK

The Engineer's Bell Book, NavShips 116, shown in figure 6-2, is a record of all bells, signals, and other orders received by the throttleman regarding movement of the ship's propellers. Entries are made in the Bell Book by the throttleman (or an assistant) as soon as an order is received. Entries are usually made by an assistant when the ship is entering or leaving port, or engaging in any maneuver which is likely to involve numerous or rapid speed changes. This procedure allows the throttleman to devote his undivided attention to answering the signals.

The Bell Book is maintained in the following manner:

1. A separate bell sheet is used for each shaft each day, except where more than one shaft is controlled by the same throttle station, in which case the same bell sheet is used to record the orders for all shafts controlled by the station. All sheets for the same date are filed together as a single record.

2. The time of receipt of the order is recorded in column number 1 (fig. 6-2).

3. The order received is recorded in column number 2. Minor speed changes (generally received via revolution telegraph) are recorded by entering the number of rpm ordered. Major speed changes (normally received via engine order telegraph) are recorded using the following symbols:

1/3 - ahead 1/3 speed
2/3 - ahead 2/3 speed
I - ahead standard speed
II - ahead full speed
III - ahead flank speed
Z - stop
B1/3 - back 1/3 speed
B2/3 - back 2/3 speed
BF - back full speed
BEM - back emergency speed

4. The number of revolutions corresponding to the major speed change ordered is entered in column 3. When the order received is recorded as rpm in column 2 (minor speed changes), no entry is made in column 3.

5. The shaft revolution counter reading (total revolutions) at the time of the speed change is recorded in column 4. The shaft revolution counter reading—as taken hourly on the hour, while underway—also is entered in column 4.

Ships and craft equipped with controllable reversible pitch propellers record in column 4 the propeller pitch in feet and fractions of feet set in response to a signalled speed change, rather than the shaft revolution counter readings. The entries for astern pitch are preceded by the letter B. Each hour on the hour, entries are made of counter readings, thus facilitating the calculation of engine miles steamed during those hours when the propeller pitch remains constant at the last value set is response to a signalled order.

Before going off watch, the engineering officer of the watch signs the Bell Book in the line following the last entry for his watch and the next officer of the watch continues the record immediately thereafter. In machinery spaces where an engineering officer of the watch is not stationed, the bell sheet is signed by the watch supervisor.

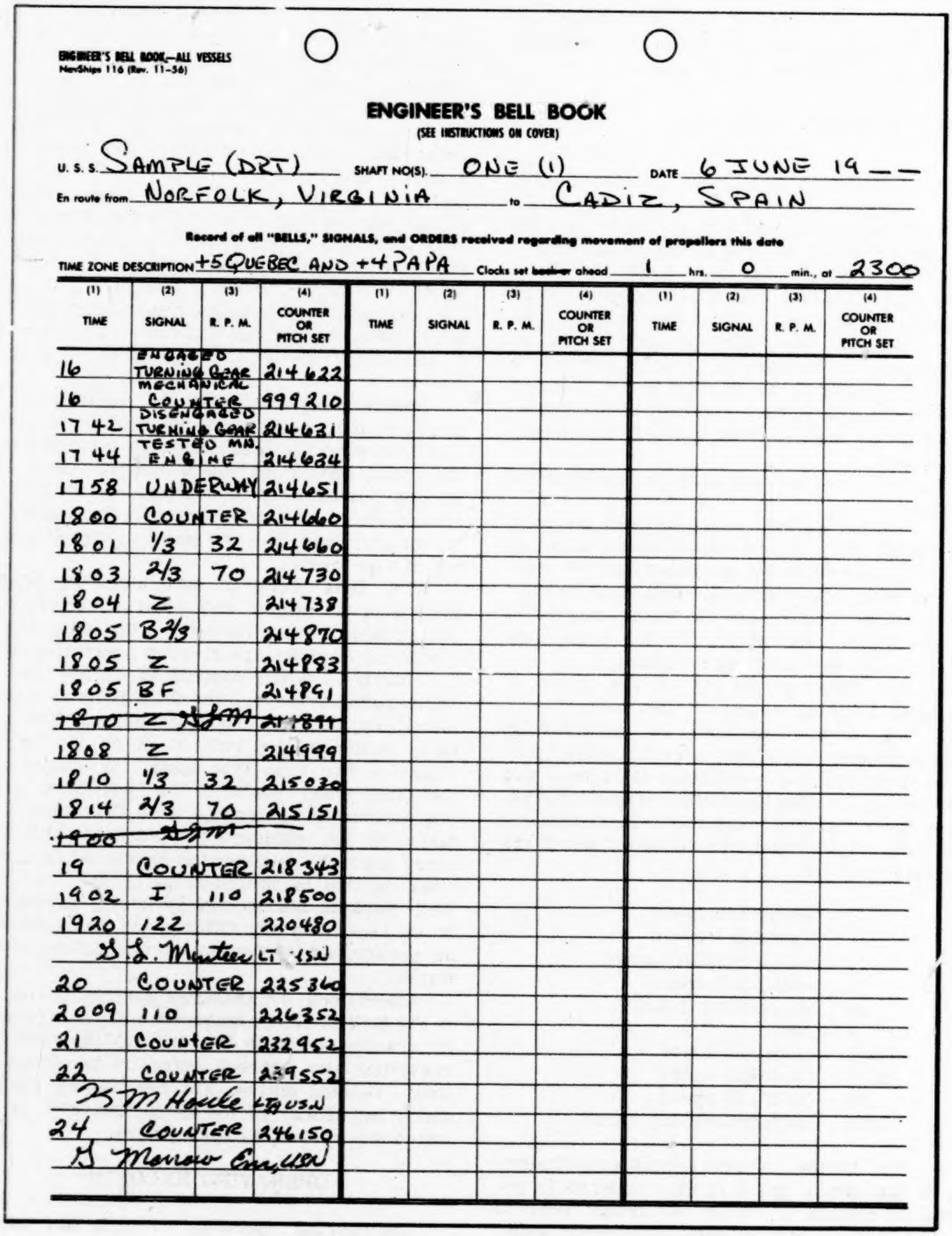
The Bell Book is maintained by bridge personnel in ships and craft equipped with controllable reversible pitch propellers, and in which the engines are directly controlled from the bridge. When control is shifted to the engineroom, however, the Bell Book is maintained by the engineroom personnel. The last entry made in the Bell Book on the bridge indicates the time that control is shifted and the first entry made in the Bell Book in the engineroom indicates the time that control is taken by the engineroom. Similarly, the last entry made by engineroom personnel indicates when control is shifted to the bridge. When the Bell Book is maintained by bridge personnel, it is signed by the OOD in the same manner as prescribed for the engineering officer of the watch.

Alterations or erasures are not permitted in the Bell Book. An incorrect entry is corrected by drawing a single line through the entry and recording the correct entry on the following line. Deleted entries are initialed by the engineering officer of the watch, the OOD, or the watch supervisor, as appropriate.

OPERATING RECORDS

Engineering operating records are meant to ensure regular inspection of operating

103



ENGINEER'S BELL BOOK—ALL VESSELS
NavShips 116 (Rev. 11-56)

ENGINEER'S BELL BOOK

(SEE INSTRUCTIONS ON COVER)

U. S. S. SAMPLE (DRT) SHAFT NO(S). ONE (1) DATE 6 JUNE 19 — —

En route from NORFOLK, VIRGINIA to CADIZ, SPAIN

Record of all "BELLS," SIGNALS, and ORDERS received regarding movement of propellers this date

TIME ZONE DESCRIPTION +5 QUEBEC AND +4 PAPA Clocks set ~~back or~~ ahead 1 hrs. 0 min., at 2300

(1) TIME	(2) SIGNAL	(3) R. P. M.	(4) COUNTER OR PITCH SET	(1) TIME	(2) SIGNAL	(3) R. P. M.	(4) COUNTER OR PITCH SET	(1) TIME	(2) SIGNAL	(3) R. P. M.	(4) COUNTER OR PITCH SET
16	ENGAGED TURNING GEAR		214622								
16	MECHANICAL COUNTER		999210								
1742	DISENGAGED TURNING GEAR		214631								
1744	TESTED MN. ENGINE		214634								
1758	UNDERWAY		214651								
1800	COUNTER		214660								
1801	1/3	32	214660								
1803	2/3	70	214730								
1804	Z		214738								
1805	B2/3		214870								
1805	Z		214883								
1805	BF		214891								
~~1810~~	~~Z~~		~~214891~~								
1808	Z		214999								
1810	1/3	32	215030								
1814	2/3	70	215151								
~~1900~~											
19	COUNTER		218343								
1902	I	110	218500								
1920	122		220480								
D. L. Minter LT USN											
20	COUNTER		225360								
2009	110		226352								
21	COUNTER		232952								
22	COUNTER		239552								
K M Houke LTJG USN											
24	COUNTER		246150								
G Monroe Ens, USN											

77.230

Figure 6-2.—Engineer's Bell Book.

machinery and to provide data for performance analysis. Operating records are not intended to replace frequent inspections of operating machinery by supervisory personnel and are not to be trusted implicitly to provide warning of impending casualties. Personnel who maintain operating records must be properly indoctrinated. They must be trained to correctly obtain, interpret, and record data and to report any abnormal conditions noted.

The type commander's directives specify which engineering operating records will be maintained and prescribe the forms to be used when no standard record forms are provided. The engineer officer may require additional operating records when (all factors considered—including the burden of added paperwork) he deems them necessary.

The operating records discussed in this chapter are generally retained on board for a period of 2 years after which time they may be destroyed in accordance with current disposal regulations. Completed records must be stowed where they will be properly preserved, and in such a manner as to ensure that any of the records can be easily located.

PROPULSION STEAM TURBINE OPERATING RECORD

The Propulsion Steam Turbine Operating Record, NavShips 3652 (fig. 6-3), is a daily record maintained for each main engine in operation. In ships with more than one main engine in the same engineroom, a separate sheet is maintained for each engine but common entries are omitted from the record for the port engine.

The watch supervisor enters the remarks and signs the record for his watch. The petty officer in charge of the engineroom checks the accuracy of the record and signs his name in the space provided on the back of the record. The main propulsion assistant notes the contents and signs the record. Any unusual conditions noted in the record are immediately reported to the engineer officer.

DIESEL ENGINE OPERATING RECORD

The Diesel Engine Operating Record, NavShips 3648 (fig. 6-3), is a complete daily record maintained for each operating propulsion and auxiliary diesel engine in the ship. Date columns (duplicates of the columns on the front of the sheet) are provided on the back of the sheet for the record of a second diesel engine. The watch supervisor writes and signs the remarks for his watch. The petty officer in charge of the ship's diesel engines (usually an ENC) checks the accuracy of the entries and signs the record in the space provided. The engineer officer notes the contents and signs his approval of the record.

AC/DC ELECTRIC PROPULSION OPERATING RECORD

The AC/DC Electric Propulsion Operating Record, NavShips 3647 (fig. 6-4) is a daily record maintained for each operating propulsion generator and motor in ships (except submarines) equipped with a-c or d-c electric propulsion machinery. A separate record sheet is used for each shaft, except on ships with more than two generators or two motors per shaft, where as many sheets as may be required are used.

Data are entered in the record and the remarks are written and signed by the Electrician's Mate of the watch. Accuracy of the entries is checked by the Electrician's Mate in charge of the electric propulsion equipment and the electrical officer. Space is provided on the record for the approval and signature of the engineer officer.

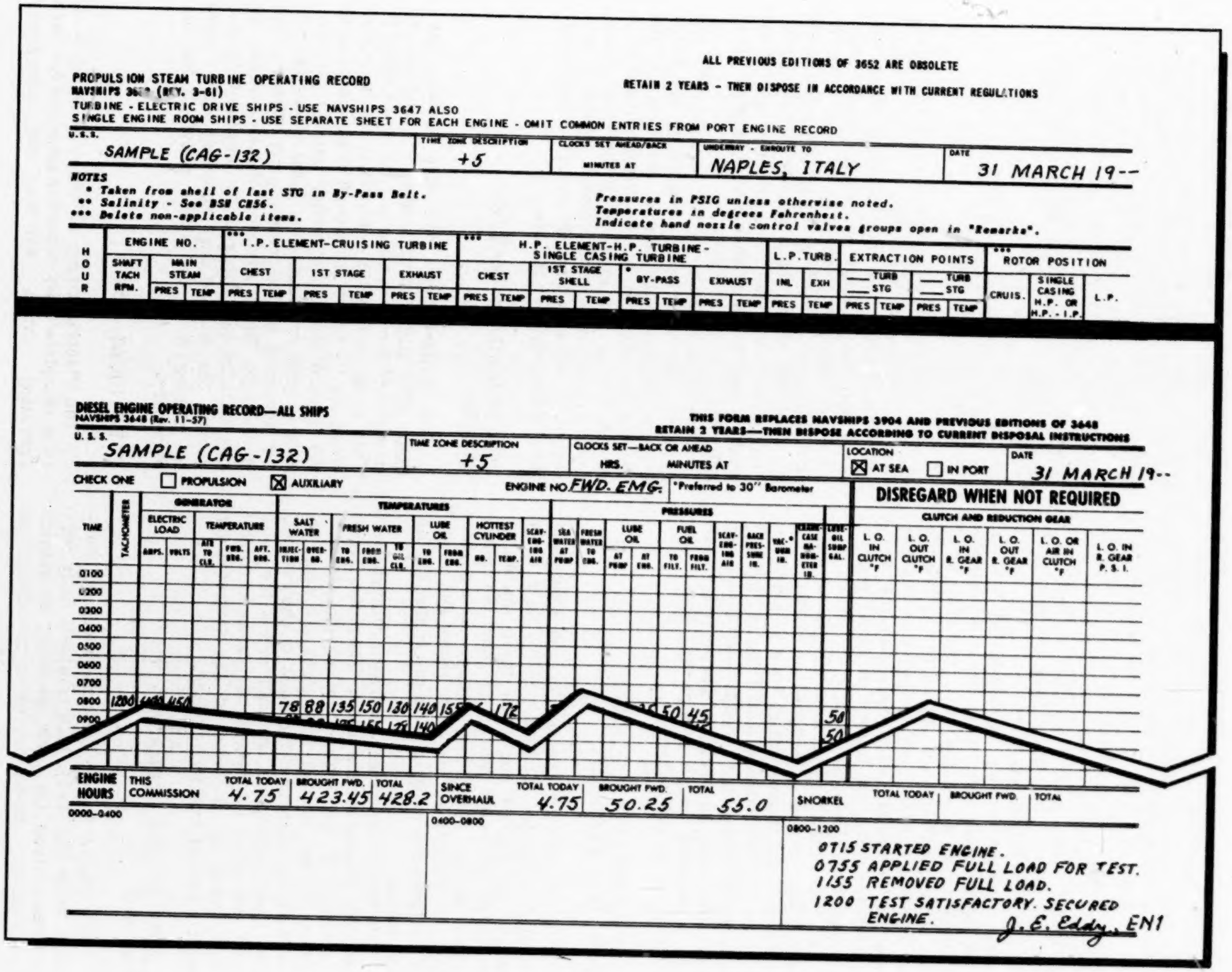
BOILER ROOM OPERATING RECORD

The Boiler Room Operating Record, NavShips 3651, (fig. 6-5) is a complete daily record maintained for each steaming fireroom. (NOTE: This form is usually referred to as the "fireroom log.") Space is provided on the back of the record for the operating data of all fireroom auxiliary machinery. Entries are checked for accuracy by the senior petty officer of the B division. The B division officer also checks and initials the record. The engineer officer checks the entries and approves the record by signing it in the space provided for his signature.

ELECTRICAL LOG

The Electrical Log, NavShips 3649 (fig. 6-6), is a complete daily record maintained for each operating ship's service and emergency

105



PROPULSION STEAM TURBINE OPERATING RECORD
NAVSHIPS 36[illegible] (REV. 3-61)
TURBINE - ELECTRIC DRIVE SHIPS - USE NAVSHIPS 3647 ALSO
SINGLE ENGINE ROOM SHIPS - USE SEPARATE SHEET FOR EACH ENGINE - OMIT COMMON ENTRIES FROM PORT ENGINE RECORD

ALL PREVIOUS EDITIONS OF 3652 ARE OBSOLETE
RETAIN 2 YEARS - THEN DISPOSE IN ACCORDANCE WITH CURRENT REGULATIONS

U.S.S.	TIME ZONE DESCRIPTION	CLOCKS SET AHEAD/BACK	UNDERWAY - ENROUTE TO	DATE
SAMPLE (CAG-132)	+5	MINUTES AT	NAPLES, ITALY	31 MARCH 19--

NOTES
* Taken from shell of last STG in By-Pass Belt.
** Salinity - See BSM CH56.
*** Delete non-applicable items.

Pressures in PSIG unless otherwise noted.
Temperatures in degrees Fahrenheit.
Indicate hand nozzle control valves groups open in "Remarks".

HOUR	ENGINE NO.			*** I.P. ELEMENT-CRUISING TURBINE						*** H.P. ELEMENT-H.P. TURBINE-SINGLE CASING TURBINE								L.P. TURB.		EXTRACTION POINTS				*** ROTOR POSITION		
	SHAFT TACH RPM.	MAIN STEAM		CHEST		1ST STAGE		EXHAUST		CHEST		1ST STAGE SHELL		* BY-PASS		EXHAUST		INL.	EXH	___ TURB ___ STG		___ TURB ___ STG		CRUIS.	SINGLE CASING H.P. OR H.P.-I.P.	L.P.
		PRES	TEMP	PRES	TEMP	PRES	TEMP	PRES	TEMP	PRES	TEMP	PRES	TEMP	PRES	TEMP	PRES	TEMP	PRES	TEMP	PRES	TEMP	PRES	TEMP			

DIESEL ENGINE OPERATING RECORD—ALL SHIPS
NAVSHIPS 3648 (Rev. 11-57)

THIS FORM REPLACES NAVSHIPS 3904 AND PREVIOUS EDITIONS OF 3648
RETAIN 2 YEARS—THEN DISPOSE ACCORDING TO CURRENT DISPOSAL INSTRUCTIONS

U. S. S.	TIME ZONE DESCRIPTION	CLOCKS SET—BACK OR AHEAD	LOCATION	DATE
SAMPLE (CAG-132)	+5	HRS. MINUTES AT	☒ AT SEA ☐ IN PORT	31 MARCH 19--

CHECK ONE ☐ PROPULSION ☒ AUXILIARY ENGINE NO FWD. EMG. *Preferred to 30" Barometer

DISREGARD WHEN NOT REQUIRED

TIME	TACHOMETER	GENERATOR					TEMPERATURES									
		ELECTRIC LOAD		TEMPERATURE			SALT WATER		FRESH WATER			LUBE OIL		HOTTEST CYLINDER		SCAVENGING AIR
		AMPS.	VOLTS	AIR TO CLR.	FWD. BRG.	AFT. BRG.	INJECTION	OVERBD.	TO ENG.	FROM ENG.	TO OIL CLR.	TO ENG.	FROM ENG.	NO.	TEMP.	
0100																
0200																
0300																
0400																
0500																
0600																
0700																
0800	1200	[illegible]	450				78	88	135	150	130	140	155	[illegible]	172	
0900							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	140				

TIME	PRESSURES											LUBE-OIL SUMP GAL.	CLUTCH AND REDUCTION GEAR					
	SEA WATER AT PUMP	FRESH WATER TO ENG.	LUBE OIL		FUEL OIL		SCAVENGING AIR	BACK PRESSURE IN.	VACUUM* IN.	CRANKCASE MANOMETER IN.			L. O. IN CLUTCH °F	L. O. OUT CLUTCH °F	L. O. IN R. GEAR °F	L. O. OUT R. GEAR °F	L. O. OR AIR IN CLUTCH °F	L. O. IN R. GEAR P. S. I.
			AT PUMP	AT ENG.	TO FILT.	FROM FILT.												
0100																		
0200																		
0300																		
0400																		
0500																		
0600																		
0700																		
0800				[illegible]	50	45						50						
0900												50						

ENGINE HOURS	THIS COMMISSION	TOTAL TODAY	BROUGHT FWD.	TOTAL	SINCE OVERHAUL	TOTAL TODAY	BROUGHT FWD.	TOTAL	SNORKEL	TOTAL TODAY	BROUGHT FWD.	TOTAL
		4.75	423.45	428.2		4.75	50.25	55.0				

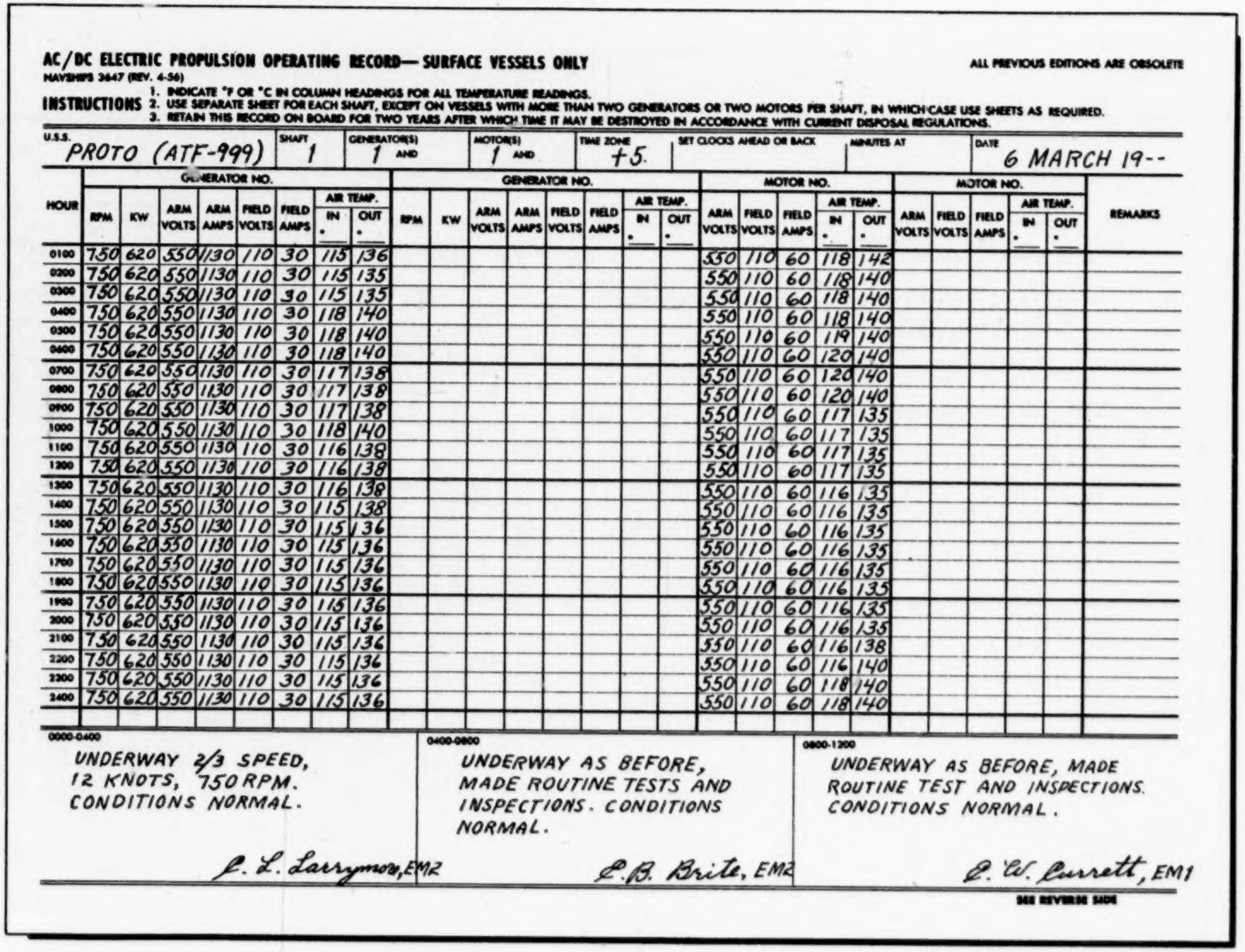
0000-0400

0400-0800

0800-1200
0715 STARTED ENGINE.
0755 APPLIED FULL LOAD FOR TEST.
1155 REMOVED FULL LOAD.
1200 TEST SATISFACTORY. SECURED ENGINE.
J. E. Eddy, EN1

114.10:.11

Figure 6-3.—Operating Records.



AC/DC ELECTRIC PROPULSION OPERATING RECORD— SURFACE VESSELS ONLY
NAVSHIPS 3647 (REV. 4-56)

ALL PREVIOUS EDITIONS ARE OBSOLETE

INSTRUCTIONS
1. INDICATE °F OR °C IN COLUMN HEADINGS FOR ALL TEMPERATURE READINGS.
2. USE SEPARATE SHEET FOR EACH SHAFT, EXCEPT ON VESSELS WITH MORE THAN TWO GENERATORS OR TWO MOTORS PER SHAFT, IN WHICH CASE USE SHEETS AS REQUIRED.
3. RETAIN THIS RECORD ON BOARD FOR TWO YEARS AFTER WHICH TIME IT MAY BE DESTROYED IN ACCORDANCE WITH CURRENT DISPOSAL REGULATIONS.

U.S.S. PROTO (ATF-999)
SHAFT 1
GENERATOR(S) 1 AND
MOTOR(S) 1 AND
TIME ZONE +5
SET CLOCKS AHEAD OR BACK
MINUTES AT
DATE 6 MARCH 19--

HOUR	GENERATOR NO.								GENERATOR NO.								MOTOR NO.					MOTOR NO.					REMARKS
	RPM	KW	ARM VOLTS	ARM AMPS	FIELD VOLTS	FIELD AMPS	AIR TEMP.		RPM	KW	ARM VOLTS	ARM AMPS	FIELD VOLTS	FIELD AMPS	AIR TEMP.		ARM VOLTS	FIELD VOLTS	FIELD AMPS	AIR TEMP.		ARM VOLTS	FIELD VOLTS	FIELD AMPS	AIR TEMP.		
							IN °	OUT °							IN °	OUT °				IN °	OUT °				IN °	OUT °	
0100	750	620	550	1130	110	30	115	136									550	110	60	118	142						
0200	750	620	550	1130	110	30	115	135									550	110	60	118	140						
0300	750	620	550	1130	110	30	115	135									550	110	60	118	140						
0400	750	620	550	1130	110	30	118	140									550	110	60	118	140						
0500	750	620	550	1130	110	30	118	140									550	110	60	119	140						
0600	750	620	550	1130	110	30	118	140									550	110	60	120	140						
0700	750	620	550	1130	110	30	117	138									550	110	60	120	140						
0800	750	620	550	1130	110	30	117	138									550	110	60	120	140						
0900	750	620	550	1130	110	30	117	138									550	110	60	117	135						
1000	750	620	550	1130	110	30	118	140									550	110	60	117	135						
1100	750	620	550	1130	110	30	116	138									550	110	60	117	135						
1200	750	620	550	1130	110	30	116	138									550	110	60	117	135						
1300	750	620	550	1130	110	30	116	138									550	110	60	116	135						
1400	750	620	550	1130	110	30	115	138									550	110	60	116	135						
1500	750	620	550	1130	110	30	115	136									550	110	60	116	135						
1600	750	620	550	1130	110	30	115	136									550	110	60	116	135						
1700	750	620	550	1130	110	30	115	136									550	110	60	116	135						
1800	750	620	550	1130	110	30	115	136									550	110	60	116	135						
1900	750	620	550	1130	110	30	115	136									550	110	60	116	135						
2000	750	620	550	1130	110	30	115	136									550	110	60	116	135						
2100	750	620	550	1130	110	30	115	136									550	110	60	116	138						
2200	750	620	550	1130	110	30	115	136									550	110	60	116	140						
2300	750	620	550	1130	110	30	115	136									550	110	60	118	140						
2400	750	620	550	1130	110	30	115	136									550	110	60	118	140						

0000-0400
UNDERWAY 2/3 SPEED, 12 KNOTS, 750 RPM. CONDITIONS NORMAL.
E. L. Larrymore, EM2

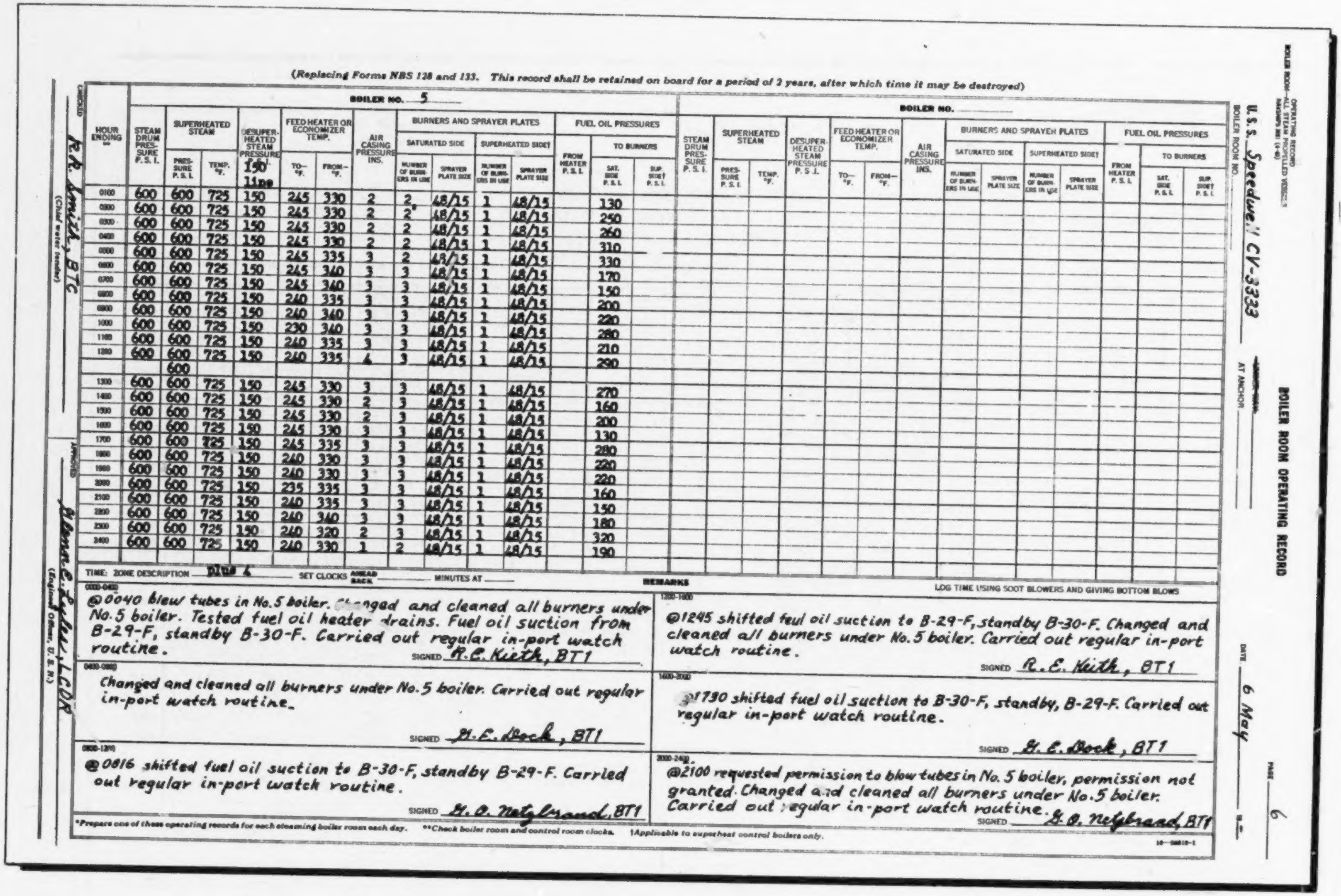
0400-0800
UNDERWAY AS BEFORE, MADE ROUTINE TESTS AND INSPECTIONS. CONDITIONS NORMAL.
E. B. Brite, EM2

0800-1200
UNDERWAY AS BEFORE, MADE ROUTINE TEST AND INSPECTIONS. CONDITIONS NORMAL.
E. W. Currett, EM1

SEE REVERSE SIDE

77.232

Figure 6-4.—AC/DC Electric Propulsion Operating Record.



OPERATING RECORD
BOILER ROOM—ALL STEAM PROPELLED VESSELS*
NAVSHIPS 361 (4-60)

BOILER ROOM OPERATING RECORD

PAGE 6

U.S.S. Speedwell CV-3333
BOILER ROOM NO. ____
~~UNDER WAY~~
AT ANCHOR ____
DATE 6 May 19__

(Replacing Forms NBS 128 and 133. This record shall be retained on board for a period of 2 years, after which time it may be destroyed)

BOILER NO. 5

HOUR ENDING**	STEAM DRUM PRESSURE P.S.I.	SUPERHEATED STEAM		DESUPERHEATED STEAM PRESSURE	FEED HEATER OR ECONOMIZER TEMP.		AIR CASING PRESSURE INS.	BURNERS AND SPRAYER PLATES				FUEL OIL PRESSURES		
								SATURATED SIDE		SUPERHEATED SIDE†			TO BURNERS	
		PRESSURE P.S.I.	TEMP. °F.	150 line	TO— °F.	FROM— °F.		NUMBER OF BURNERS IN USE	SPRAYER PLATE SIZE	NUMBER OF BURNERS IN USE	SPRAYER PLATE SIZE	FROM HEATER P.S.I.	SAT. SIDE P.S.I.	SUP. SIDE† P.S.I.
0100	600	600	725	150	245	330	2	2	48/15	1	48/15		130	
0200	600	600	725	150	245	330	2	2	48/15	1	48/15		250	
0300	600	600	725	150	245	330	2	2	48/15	1	48/15		260	
0400	600	600	725	150	245	330	2	2	48/15	1	48/15		310	
0500	600	600	725	150	245	335	3	2	48/15	1	48/15		330	
0600	600	600	725	150	245	340	3	3	48/15	1	48/15		170	
0700	600	600	725	150	245	340	3	3	48/15	1	48/15		150	
0800	600	600	725	150	240	335	3	3	48/15	1	48/15		200	
0900	600	600	725	150	240	340	3	3	48/15	1	48/15		220	
1000	600	600	725	150	230	340	3	3	48/15	1	48/15		280	
1100	600	600	725	150	240	335	3	3	48/15	1	48/15		210	
1200	600	600	725	150	240	335	4	3	48/15	1	48/15		290	
		600												
1300	600	600	725	150	245	330	3	3	48/15	1	48/15		270	
1400	600	600	725	150	245	330	2	3	48/15	1	48/15		160	
1500	600	600	725	150	245	330	2	3	48/15	1	48/15		200	
1600	600	600	725	150	245	330	3	3	48/15	1	48/15		130	
1700	600	600	725	150	245	335	3	3	48/15	1	48/15		280	
1800	600	600	725	150	240	330	3	3	48/15	1	48/15		220	
1900	600	600	725	150	240	330	3	3	48/15	1	48/15		220	
2000	600	600	725	150	235	335	3	3	48/15	1	48/15		160	
2100	600	600	725	150	240	335	3	3	48/15	1	48/15		150	
2200	600	600	725	150	240	340	3	3	48/15	1	48/15		180	
2300	600	600	725	150	240	320	2	3	48/15	1	48/15		320	
2400	600	600	725	150	240	330	1	2	48/15	1	48/15		190	

BOILER NO. ____

STEAM DRUM PRESSURE P.S.I.	SUPERHEATED STEAM		DESUPERHEATED STEAM PRESSURE P.S.I.	FEED HEATER OR ECONOMIZER TEMP.		AIR CASING PRESSURE INS.	BURNERS AND SPRAYER PLATES				FUEL OIL PRESSURES		
							SATURATED SIDE		SUPERHEATED SIDE†			TO BURNERS	
	PRESSURE P.S.I.	TEMP. °F.		TO— °F.	FROM— °F.		NUMBER OF BURNERS IN USE	SPRAYER PLATE SIZE	NUMBER OF BURNERS IN USE	SPRAYER PLATE SIZE	FROM HEATER P.S.I.	SAT. SIDE P.S.I.	SUP. SIDE† P.S.I.

TIME: ZONE DESCRIPTION plus 4 SET CLOCKS AHEAD/BACK ____ MINUTES AT ____

REMARKS

LOG TIME USING SOOT BLOWERS AND GIVING BOTTOM BLOWS

0000-0400
@0040 blew tubes in No. 5 boiler. Changed and cleaned all burners under No. 5 boiler. Tested fuel oil heater drains. Fuel oil suction from B-29-F, standby B-30-F. Carried out regular in-port watch routine.
SIGNED R. E. Kieth, BT1

0400-0800
Changed and cleaned all burners under No. 5 boiler. Carried out regular in-port watch routine.
SIGNED G. E. Dock, BT1

0800-1200
@0816 shifted fuel oil suction to B-30-F, standby B-29-F. Carried out regular in-port watch routine.
SIGNED G. O. Netzbrand, BT1

1200-1600
@1245 shifted feul oil suction to B-29-F, standby B-30-F. Changed and cleaned all burners under No. 5 boiler. Carried out regular in-port watch routine.
SIGNED R. E. Keith, BT1

1600-2000
@1730 shifted fuel oil suction to B-30-F, standby, B-29-F. Carried out regular in-port watch routine.
SIGNED G. E. Dock, BT1

2000-2400
@2100 requested permission to blow tubes in No. 5 boiler, permission not granted. Changed and cleaned all burners under No. 5 boiler. Carried out regular in-port watch routine.
SIGNED G. O. Netzbrand, BT1

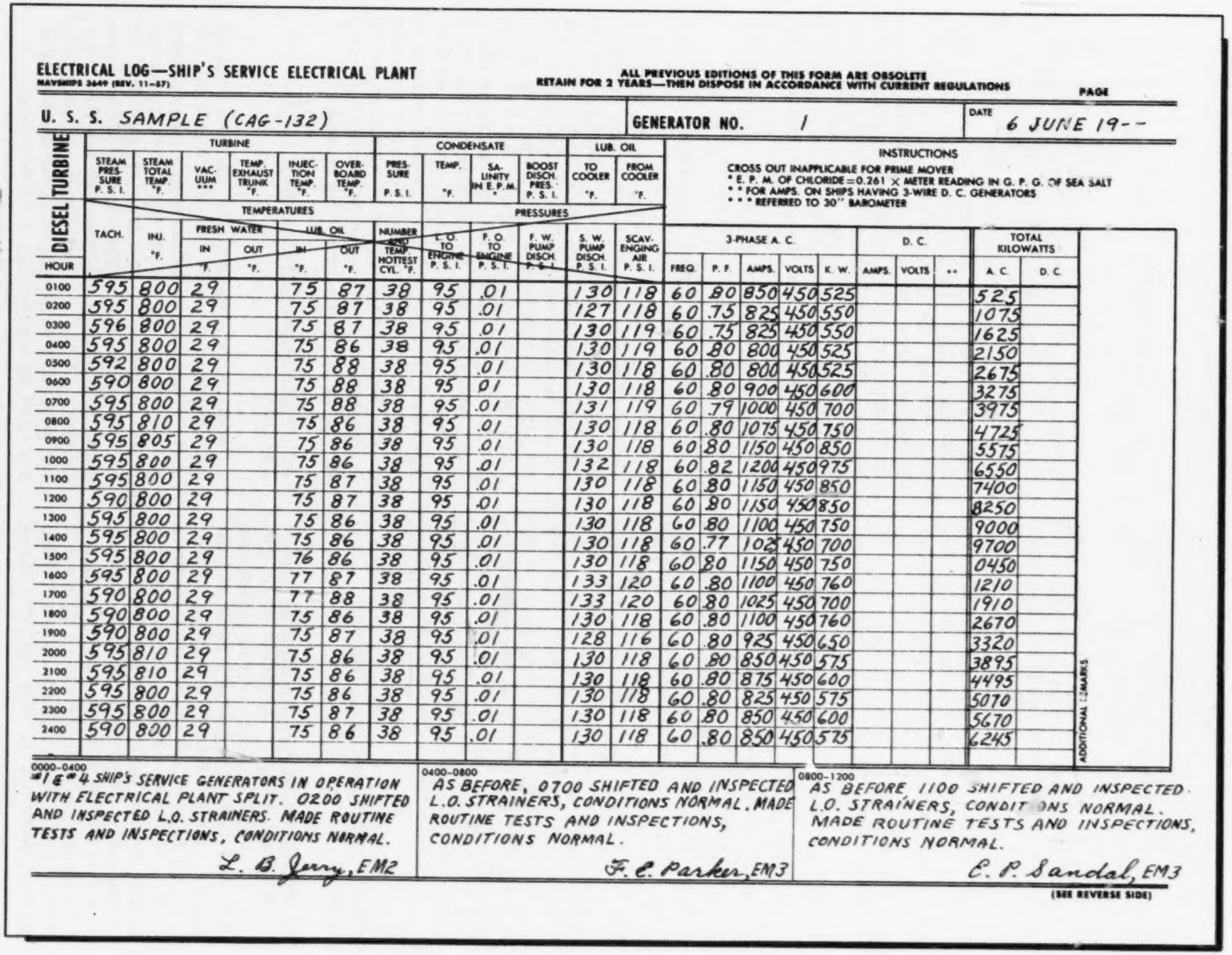
*Prepare one of these operating records for each steaming boiler room each day. **Check boiler room and control room clocks. †Applicable to superheat control boilers only.

CHECKED R. R. Smith, BTC
(Chief water tender)

APPROVED Glenn E. Lyles, LCDR
(Engineer Officer, U. S. N.)

Figure 6-5.—Boiler Room Operating Record.

98.163



ELECTRICAL LOG—SHIP'S SERVICE ELECTRICAL PLANT
NAVSHIPS 3649 (REV. 11-57)

ALL PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE
RETAIN FOR 2 YEARS—THEN DISPOSE IN ACCORDANCE WITH CURRENT REGULATIONS

PAGE

U. S. S. SAMPLE (CAG-132)

GENERATOR NO. 1

DATE 6 JUNE 19--

INSTRUCTIONS
CROSS OUT INAPPLICABLE FOR PRIME MOVER
* E. P. M. OF CHLORIDE = 0.261 × METER READING IN G. P. G. OF SEA SALT
** FOR AMPS. ON SHIPS HAVING 3-WIRE D. C. GENERATORS
*** REFERRED TO 30" BAROMETER

TURBINE	TURBINE						CONDENSATE				LUB. OIL												
	STEAM PRESSURE P. S. I.	STEAM TOTAL TEMP. °F.	VACUUM ***	TEMP. EXHAUST TRUNK °F.	INJECTION TEMP. °F.	OVERBOARD TEMP. °F.	PRESSURE P. S. I.	TEMP. °F.	SALINITY IN E.P.M. *	BOOST DISCH. PRES. P. S. I.	TO COOLER °F.	FROM COOLER °F.											
DIESEL		TEMPERATURES						PRESSURES					3-PHASE A. C.					D. C.			TOTAL KILOWATTS		ADDITIONAL REMARKS
			FRESH WATER		LUB. OIL																		
HOUR	TACH.	INJ. °F.	IN °F.	OUT °F.	IN °F.	OUT °F.	NUMBER AND TEMP. HOTTEST CYL. °F.	L. O. TO ENGINE P. S. I.	F. O. TO ENGINE P. S. I.	F. W. PUMP DISCH. P. S. I.	S. W. PUMP DISCH. P. S. I.	SCAVENGING AIR P. S. I.	FREQ.	P. F.	AMPS.	VOLTS	K. W.	AMPS.	VOLTS	**	A. C.	D. C.	
0100	595	800	29		75	87	38	95	.01		130	118	60	.80	850	450	525				525		
0200	595	800	29		75	87	38	95	.01		127	118	60	.75	825	450	550				1075		
0300	596	800	29		75	87	38	95	.01		130	119	60	.75	825	450	550				1625		
0400	595	800	29		75	86	38	95	.01		130	119	60	.80	800	450	525				2150		
0500	592	800	29		75	88	38	95	.01		130	118	60	.80	800	450	525				2675		
0600	590	800	29		75	88	38	95	01		130	118	60	.80	900	450	600				3275		
0700	595	800	29		75	88	38	95	.01		131	119	60	.79	1000	450	700				3975		
0800	595	810	29		75	86	38	95	.01		130	118	60	.80	1075	450	750				4725		
0900	595	805	29		75	86	38	95	.01		130	118	60	.80	1150	450	850				5575		
1000	595	800	29		75	86	38	95	.01		132	118	60	.82	1200	450	975				6550		
1100	595	800	29		75	87	38	95	.01		130	118	60	.80	1150	450	850				7400		
1200	590	800	29		75	87	38	95	.01		130	118	60	.80	1150	450	850				8250		
1300	595	800	29		75	86	38	95	.01		130	118	60	.80	1100	450	750				9000		
1400	595	800	29		75	86	38	95	.01		130	118	60	.77	1025	450	700				9700		
1500	595	800	29		76	86	38	95	.01		130	118	60	.80	1150	450	750				0450		
1600	595	800	29		77	87	38	95	.01		133	120	60	.80	1100	450	760				1210		
1700	590	800	29		77	88	38	95	.01		133	120	60	.80	1025	450	700				1910		
1800	590	800	29		75	86	38	95	.01		130	118	60	.80	1100	450	760				2670		
1900	590	800	29		75	87	38	95	.01		128	116	60	.80	925	450	650				3320		
2000	595	810	29		75	86	38	95	.01		130	118	60	.80	850	450	575				3895		
2100	595	810	29		75	86	38	95	.01		130	118	60	.80	875	450	600				4495		
2200	595	800	29		75	86	38	95	.01		130	118	60	.80	825	450	575				5070		
2300	595	800	29		75	87	38	95	.01		130	118	60	.80	850	450	600				5670		
2400	590	800	29		75	86	38	95	.01		130	118	60	.80	850	450	575				6245		

0000-0400
#1 & #4 SHIP'S SERVICE GENERATORS IN OPERATION WITH ELECTRICAL PLANT SPLIT. 0200 SHIFTED AND INSPECTED L.O. STRAINERS. MADE ROUTINE TESTS AND INSPECTIONS, CONDITIONS NORMAL.
L. B. Jerry, EM2

0400-0800
AS BEFORE, 0700 SHIFTED AND INSPECTED L.O. STRAINERS, CONDITIONS NORMAL. MADE ROUTINE TESTS AND INSPECTIONS, CONDITIONS NORMAL.
F. C. Parker, EM3

0800-1200
AS BEFORE 1100 SHIFTED AND INSPECTED L.O. STRAINERS, CONDITIONS NORMAL. MADE ROUTINE TESTS AND INSPECTIONS, CONDITIONS NORMAL.
E. P. Sandal, EM3

(SEE REVERSE SIDE)

Figure 6-6.—Electrical log for ship's service electrical plant.

77.231

generator. Entries concerning the prime movers are generally recorded by the generator watch (Machinist's Mate) and electrical data are recorded by the switchboard watch (Electrician's Mate) who also writes and signs the remarks for his watch.

The accuracy of the entries is checked by the Electrician's Mate in charge of the ship's service generators. Both the M and E division officers check the record for accuracy and any evidence of impending casualties. Each officer initials the record to indicate he has checked it. The engineer officer notes the content and signs the record in the space provided.

DISTILLING PLANT OPERATING RECORDS

There is a distilling plant operating record for each of the three principal types of distilling plants in use aboard ship. The records are (1) the Low Pressure Distilling Plant Operating Record, NavShips 3676 (fig. 6-7); (2) the Flash Type Distilling Plant Operating Record, NavShips 3676-1; and (3) the Vapor Compression Distilling Plant Operating Record, NavShips 3675. Each record is a complete daily record maintained for each applicable distilling plant in operation. Data and remarks in the record are recorded by personnel of the watch. The watch supervisor signs the remarks for his watch, and the petty officer in charge of the ship's distilling plants checks all entries for accuracy and signs the record. The division officer (M or A, as applicable) reviews and initials the record. Space is provided on the back of the record for the signature of the engineer officer.

REFRIGERATION/AIR CONDITIONING EQUIPMENT

The Refrigeration/Air Conditioning Equipment Operating Record, NavShips 4731 (fig. 6-8), is a complete daily record maintained for each operating refrigeration plant and air conditioning plant (except packaged units). Spaces on the front of the record are for entries applicable to both refrigeration and air conditioning plants (part A of fig. 6-8). The differences between entries made on the back of the record are illustrated in part B of figure 6-8 (refrigeration) and part C of figure 6-8 (air conditioning). Note that data are recorded at two-hour intervals in this record. The A division officer reviews the contents and initials the record.

GYROCOMPASS OPERATING RECORD

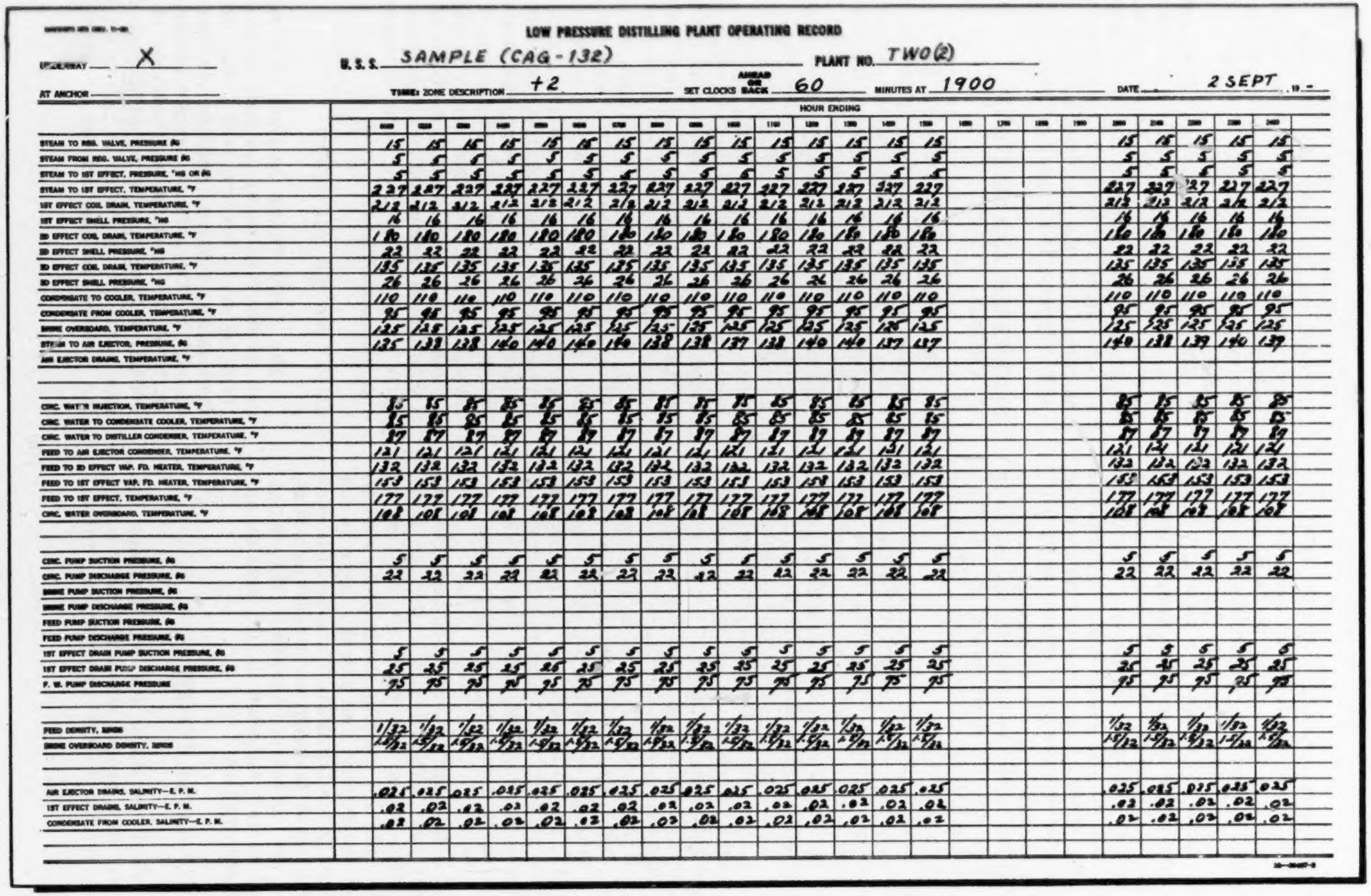
The Gyrocompass Operating Record (Gyrocompass Log) is a locally prepared, complete daily record maintained for each operating master gyrocompass. The form for the log is prepared in accordance with the type commander's directives. Columns in the log provide space for recording the times of starting and stopping the gyrocompass, total hours of operation since delivery of the gyrocompass, and important operating data pertaining to the gyrocompass installation. Preventive maintenance performed (routine oiling and cleaning) and operating conditions noted are recorded in the remarks section of the log. The petty officer in charge of the interior communications equipment checks the accuracy of the log and the electrical officer notes its contents.

I. C. ROOM OPERATING RECORD

The I. C. Room Operating Record is a daily record of major electrical equipment in operation in the I. C. room and is maintained by the interior communications watch. The form for the record is prepared locally in accordance with the type commander's directives. On small ships the gyrocompass log and the I. C. room record may be maintained on the same form. Important data such as voltages and currents of major units of interior communications equipment (I. C. switchboard, telephone switchboard, and motor generator sets) are recorded on the form. The I. C. room operating record is checked and approved in the manner described for the gyrocompass operating record.

AIR COMPRESSOR OPERATING RECORD

Some large ships maintain an Air Compressor Operating Record. The record contains important data such as temperatures and pressures pertaining to air compressors in operation. When required by the type commander, the air compressor operating record form is prepared locally in accordance with his directives. Contents of the record should be checked by the petty officer in charge of the air compressors and the appropriate division officer.



LOW PRESSURE DISTILLING PLANT OPERATING RECORD

UNDERWAY X
AT ANCHOR
U.S.S. SAMPLE (CAG-132)
PLANT NO. TWO(2)
TIME: ZONE DESCRIPTION +2
SET CLOCKS AHEAD OR BACK 60 MINUTES AT 1900
DATE 2 SEPT, 19 -

HOUR ENDING

		0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	
STEAM TO RED. VALVE, PRESSURE PSIG		15	15	15	15	15	15	15	15	15	15	15	15	15	15	15					15	15	15	15	15	
STEAM FROM RED. VALVE, PRESSURE PSIG		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5					5	5	5	5	5	
STEAM TO 1ST EFFECT, PRESSURE, "HG OR PSIG		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5					5	5	5	5	5	
STEAM TO 1ST EFFECT, TEMPERATURE, °F		227	227	227	227	227	227	227	227	227	227	227	227	227	227	227					227	227	227	227	227	
1ST EFFECT COIL DRAIN, TEMPERATURE, °F		212	212	212	212	212	212	212	212	212	212	212	212	212	212	212					212	212	212	212	212	
1ST EFFECT SHELL PRESSURE, "HG		16	16	16	16	16	16	16	16	16	16	16	16	16	16	16					16	16	16	16	16	
2D EFFECT COIL DRAIN, TEMPERATURE, °F		180	180	180	180	180	180	180	180	180	180	180	180	180	180	180					180	180	180	180	180	
2D EFFECT SHELL PRESSURE, "HG		22	22	22	22	22	22	22	22	22	22	22	22	22	22	22					22	22	22	22	22	
3D EFFECT COIL DRAIN, TEMPERATURE, °F		135	135	135	135	135	135	135	135	135	135	135	135	135	135	135					135	135	135	135	135	
3D EFFECT SHELL PRESSURE, "HG		26	26	26	26	26	26	26	26	26	26	26	26	26	26	26					26	26	26	26	26	
CONDENSATE TO COOLER, TEMPERATURE, °F		110	110	110	110	110	110	110	110	110	110	110	110	110	110	110					110	110	110	110	110	
CONDENSATE FROM COOLER, TEMPERATURE, °F		95	95	95	95	95	95	95	95	95	95	95	95	95	95	95					95	95	95	95	95	
BRINE OVERBOARD, TEMPERATURE, °F		125	125	125	125	125	125	125	125	125	125	125	125	125	125	125					125	125	125	125	125	
STEAM TO AIR EJECTOR, PRESSURE, PSIG		135	138	128	140	140	140	140	138	138	137	138	140	140	137	137					140	138	139	140	139	
AIR EJECTOR DRAINS, TEMPERATURE, °F																										
CIRC. WAT'R INJECTION, TEMPERATURE, °F		85	85	85	85	85	85	85	85	85	85	85	85	85	85	85					85	85	85	85	85	
CIRC. WATER TO CONDENSATE COOLER, TEMPERATURE, °F		85	85	85	85	85	85	85	85	85	85	85	85	85	85	85					85	85	85	85	85	
CIRC. WATER TO DISTILLER CONDENSER, TEMPERATURE, °F		87	87	87	87	87	87	87	87	87	87	87	89	89	87	87					87	87	87	87	89	
FEED TO AIR EJECTOR CONDENSER, TEMPERATURE, °F		121	121	121	121	121	121	121	121	121	121	121	121	121	131	121					121	121	121	121	121	
FEED TO 2D EFFECT VAP. FD. HEATER, TEMPERATURE, °F		132	132	132	132	132	132	132	132	132	132	132	132	132	132	132					132	132	132	132	132	
FEED TO 1ST EFFECT VAP. FD. HEATER, TEMPERATURE, °F		153	153	153	153	153	153	153	153	153	153	153	153	153	153	153					153	153	153	153	153	
FEED TO 1ST EFFECT, TEMPERATURE, °F		177	177	177	177	177	177	177	177	177	177	177	177	177	177	177					177	177	177	177	177	
CIRC. WATER OVERBOARD, TEMPERATURE, °F		108	108	108	108	108	108	108	108	108	108	108	108	108	108	108					108	108	108	108	108	
CIRC. PUMP SUCTION PRESSURE, PSIG		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5					5	5	5	5	5	
CIRC. PUMP DISCHARGE PRESSURE, PSIG		22	22	22	22	22	22	22	22	22	22	22	22	22	22	22					22	22	22	22	22	
BRINE PUMP SUCTION PRESSURE, PSIG																										
BRINE PUMP DISCHARGE PRESSURE, PSIG																										
FEED PUMP SUCTION PRESSURE, PSIG																										
FEED PUMP DISCHARGE PRESSURE, PSIG																										
1ST EFFECT DRAIN PUMP SUCTION PRESSURE, PSIG		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5					5	5	5	5	5	
1ST EFFECT DRAIN PUMP DISCHARGE PRESSURE, PSIG		25	25	25	25	25	25	25	25	25	25	25	25	25	25	25					25	25	25	25	25	
F. W. PUMP DISCHARGE PRESSURE		75	75	75	75	75	75	75	75	75	75	75	75	75	75	75					75	75	75	75	75	
FEED DENSITY, 32NDS		1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32					1/32	1/32	1/32	1/32	1/32	
BRINE OVERBOARD DENSITY, 32NDS		1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	1.5/32					1.5/32	1.5/32	1.5/32	1.5/32	1.5/32	
AIR EJECTOR DRAINS, SALINITY—E. P. M.		.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025	.025					.025	.025	.025	.025	.025	
1ST EFFECT DRAINS, SALINITY—E. P. M.		.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02					.02	.02	.02	.02	.02	
CONDENSATE FROM COOLER, SALINITY—E. P. M.		.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02					.02	.02	.02	.02	.02	

47.137

Figure 6-7.—Low Pressure Distilling Plant Operating Record.

FUEL AND WATER ACCOUNTS

The maintenance of daily fuel oil, lubricating oil, water and diesel oil accounts is vital to the efficient operation of the engineering department. Forms and procedures necessary to account for and preserve a limited supply of fresh water and fuel are generally prescribed by the type commanders. Chapter 9004(6) of NavShips Technical Manual describes the fuel and water accounts that NavShips considers indispensable to the engineering department. Principally, these accounts inform the engineer officer of the status of the ship's liquid load, and form the basis of several important reports submitted to higher authority by the engineer officer. One of the most important of these reports is the report of the amount of burnable fuel on hand.

It is fundamental to all naval operations that all ship and unit commanders know the exact amount of burnable fuel on hand. Depending on the type of propulsion plant, burnable fuel can be Navy special fuel oil (NSFO), JP-5, or diesel oil. (NOTE: Diesel oil is no longer referred to as "diol.") It is good engineering practice to fuel all fuel oil tanks to 95 percent of volumetric capacity in order to allow for expansion and prevent spillage. When submitting fuel reports, the 95-percent volumetric capacity of the tanks is used as the base for the 100-percent burnable fuel report. It is possible, however, to fuel above the 95-percent volumetric capacity. When fueled to 100-percent volumetric capacity the burnable fuel percentage figure will exceed 100 percent. The engineer officer should not hesitate to report burnable fuel in excess of 100 percent when this amount is actually on board.

When computing the amount of burnable fuel on board, only the fuel oil in storage tanks and service tanks is considered. All fuel oil below the service suction and transfer suction tailpipes in service and storage tanks is not considered to be burnable. The fuel oil in contaminated tanks (settling or separating tanks), also, is not considered burnable. The design height of suction tailpipes is indicated on applicable ship's plans.

FUEL AND WATER REPORT

The Fuel and Water Report, NavShips 115 (fig. 6-9), is a report submitted daily by the engineer officer to the commanding officer. The report indicates the amount of fuel (fuel oil and diesel oil) and water on hand as of midnight the previous day. The report also includes the previous day's feed and potable water performance, results of water tests, and the steaming hours on boiler firesides and watersides.

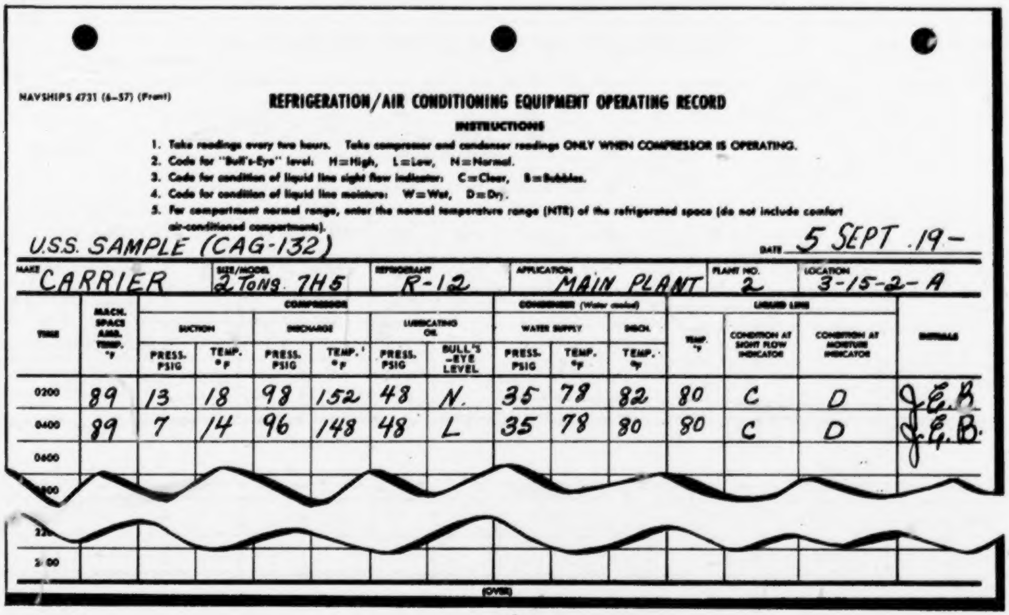
The Fuel and Water report is compiled from data obtained from the Daily Fuel and Lube Oil Account and the Daily Water Account. The original and one copy of the report is delivered to the officer of the deck in sufficient time for submission to the commanding officer with the 1200 reports. The copy is retained by the OOD.

DAILY FUEL AND LUBE OIL ACCOUNT

The Daily Fuel and Lube Oil Account is generally a single daily record sheet indicating the receipt, use, expenditure, transfer, and changes by inventory or apparent meter error of the contents of each fuel oil, diesel oil, and lubricating oil tank throughout the ship. A suggested format for the account is illustrated in chapter 9004 (6) of NavShips Technical Manual. When the form for the daily fuel and lube oil account is not prescribed by the type commander, engineer officers may utilize the suggested format. Where it is impracticable to consolidate the lube and fuel oil accounts, ships may maintain separate accounts for lube oil. An account form should be submitted before and after receiving or delivering fuel oil. The form is prepared by the oil king and is checked for accuracy by his leading petty officer and division officer. When completed and checked, the form is submitted to the engineer officer for his approval and signature. The information contained in the record is the basis of reports submitted to higher authority (commanding officer and force or unit commander) by the engineer officer.

DAILY WATER ACCOUNT

The Daily Water Account is a daily record of the feed water for boilers and potable fresh water in reserve feed tanks, deaerating feed tanks, boilers, and potable water tanks throughout the ship. A sample format for the Daily Water Account is illustrated in chapter 9004(6) of NavShips Technical Manual. The data are recorded on the form by the oil king and the record is checked for accuracy by his



NAVSHIPS 4731 (6-57) (Front)

REFRIGERATION/AIR CONDITIONING EQUIPMENT OPERATING RECORD

INSTRUCTIONS

1. Take readings every two hours. Take compressor and condenser readings ONLY WHEN COMPRESSOR IS OPERATING.
2. Code for "Bull's-Eye" level: H=High, L=Low, N=Normal.
3. Code for condition of liquid line sight flow indicator: C=Clear, B=Bubbles.
4. Code for condition of liquid line moisture: W=Wet, D=Dry.
5. For compartment normal range, enter the normal temperature range (NTR) of the refrigerated space (do not include comfort air-conditioned compartments).

U.S.S. SAMPLE (CAG-132)

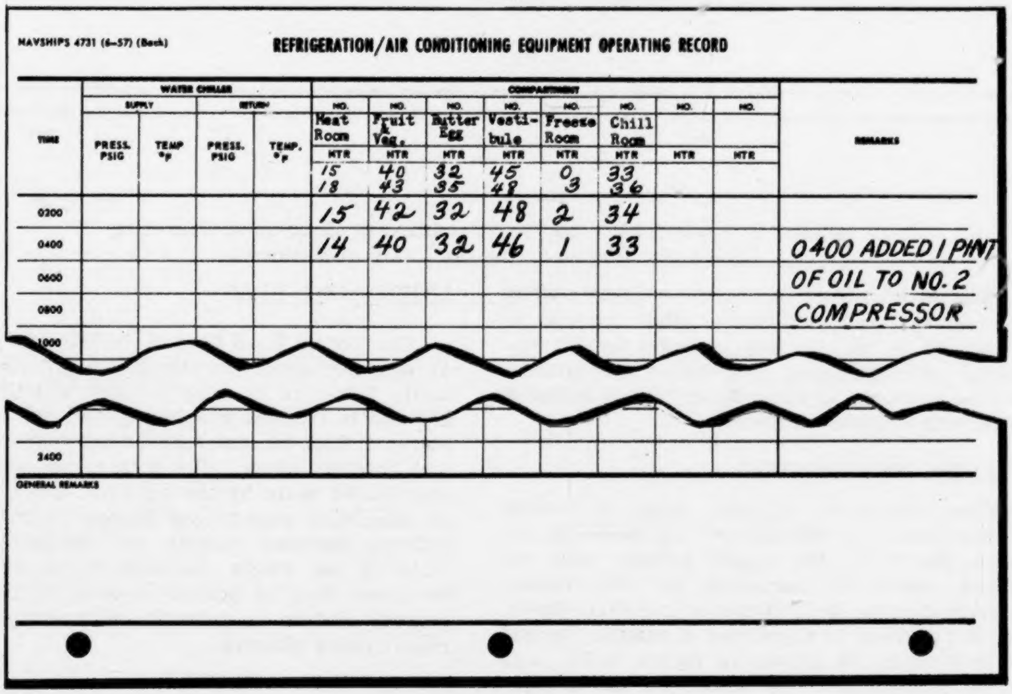
DATE 5 SEPT. 19—

MAKE	SIZE/MODEL	REFRIGERANT	APPLICATION	PLANT NO.	LOCATION
CARRIER	2 TONS 7H5	R-12	MAIN PLANT	2	3-15-2-A

TIME	MACH. SPACE AMB. TEMP. °F	COMPRESSOR						CONDENSER (Water cooled)			LIQUID LINE			INITIALS
		SUCTION		DISCHARGE		LUBRICATING OIL		WATER SUPPLY		DISCH.	TEMP. °F	CONDITION AT SIGHT FLOW INDICATOR	CONDITION AT MOISTURE INDICATOR	
		PRESS. PSIG	TEMP. °F	PRESS. PSIG	TEMP. °F	PRESS. PSIG	BULL'S-EYE LEVEL	PRESS. PSIG	TEMP. °F	TEMP. °F				
0200	89	13	18	98	152	48	N.	35	78	82	80	C	D	J.E.B.
0400	89	7	14	96	148	48	L	35	78	80	80	C	D	J.E.B.
0600														
2400														

(OVER)

A



NAVSHIPS 4731 (6-57) (Back)

REFRIGERATION/AIR CONDITIONING EQUIPMENT OPERATING RECORD

TIME	WATER CHILLER				COMPARTMENT								REMARKS
	SUPPLY		RETURN		NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	
	PRESS. PSIG	TEMP °F	PRESS. PSIG	TEMP. °F	Meat Room	Fruit & Veg.	Butter Egg	Vestibule	Freeze Room	Chill Room			
					NTR	NTR	NTR	NTR	NTR	NTR	NTR	NTR	
					15 18	40 43	32 35	45 48	0 3	33 36			
0200					15	42	32	48	2	34			
0400					14	40	32	46	1	33			0400 ADDED 1 PINT
0600													OF OIL TO NO. 2
0800													COMPRESSOR
1000													
2400													

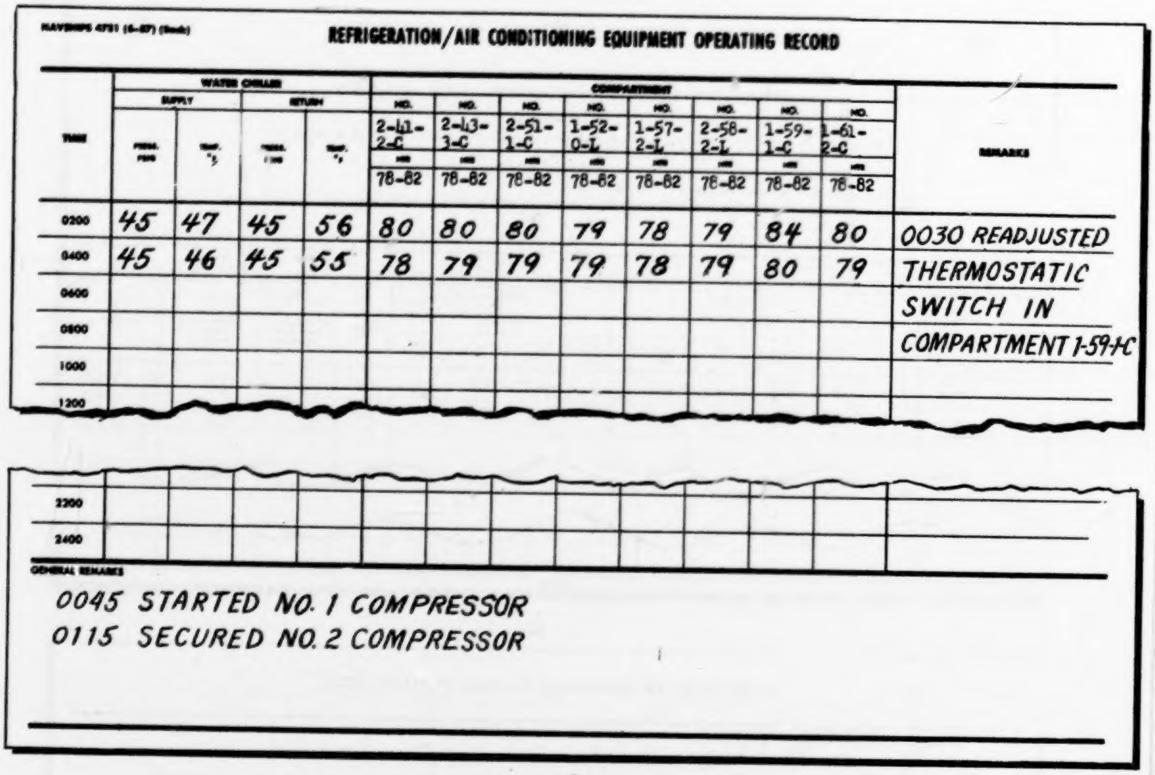
GENERAL REMARKS

B

47.104

Figure 6-8.—Refrigeration/Air Conditioning Equipment Operating Record (refrigeration). A. Front B. Back.

113



NAVSHIPS 4731 (6-67) (Back)

REFRIGERATION/AIR CONDITIONING EQUIPMENT OPERATING RECORD

TIME	WATER CHILLER				COMPARTMENT								REMARKS
	SUPPLY		RETURN		NO.	NO.	NO.	NO.	NO.	NO.	NO.	NO.	
	PRESS. PSIG	TEMP. °F	PRESS. PSIG	TEMP. °F	2-41-2-C	2-43-3-C	2-51-1-C	1-52-0-L	1-57-2-L	2-58-2-L	1-59-1-C	1-61-2-C	
					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
					78-82	78-82	78-82	78-82	78-82	78-82	78-82	78-82	
0200	45	47	45	56	80	80	80	79	78	79	84	80	0030 READJUSTED
0400	45	46	45	55	78	79	79	79	78	79	80	79	THERMOSTATIC
0600													SWITCH IN
0800													COMPARTMENT 1-59-1-C
1000													
1200													
2200													
2400													

GENERAL REMARKS

0045 STARTED NO. 1 COMPRESSOR

0115 SECURED NO. 2 COMPRESSOR

C

47.104

Figure 6-8.—Refrigeration/Air Conditioning Equipment Operating Record—continued. C. Back (air-conditioning).

leading petty officer and division officer. When completed and checked, the record is submitted to the engineer officer for his approval and signature. The daily water account is also a source of information that is included in reports to higher authority.

FUELING MEMORANDUM

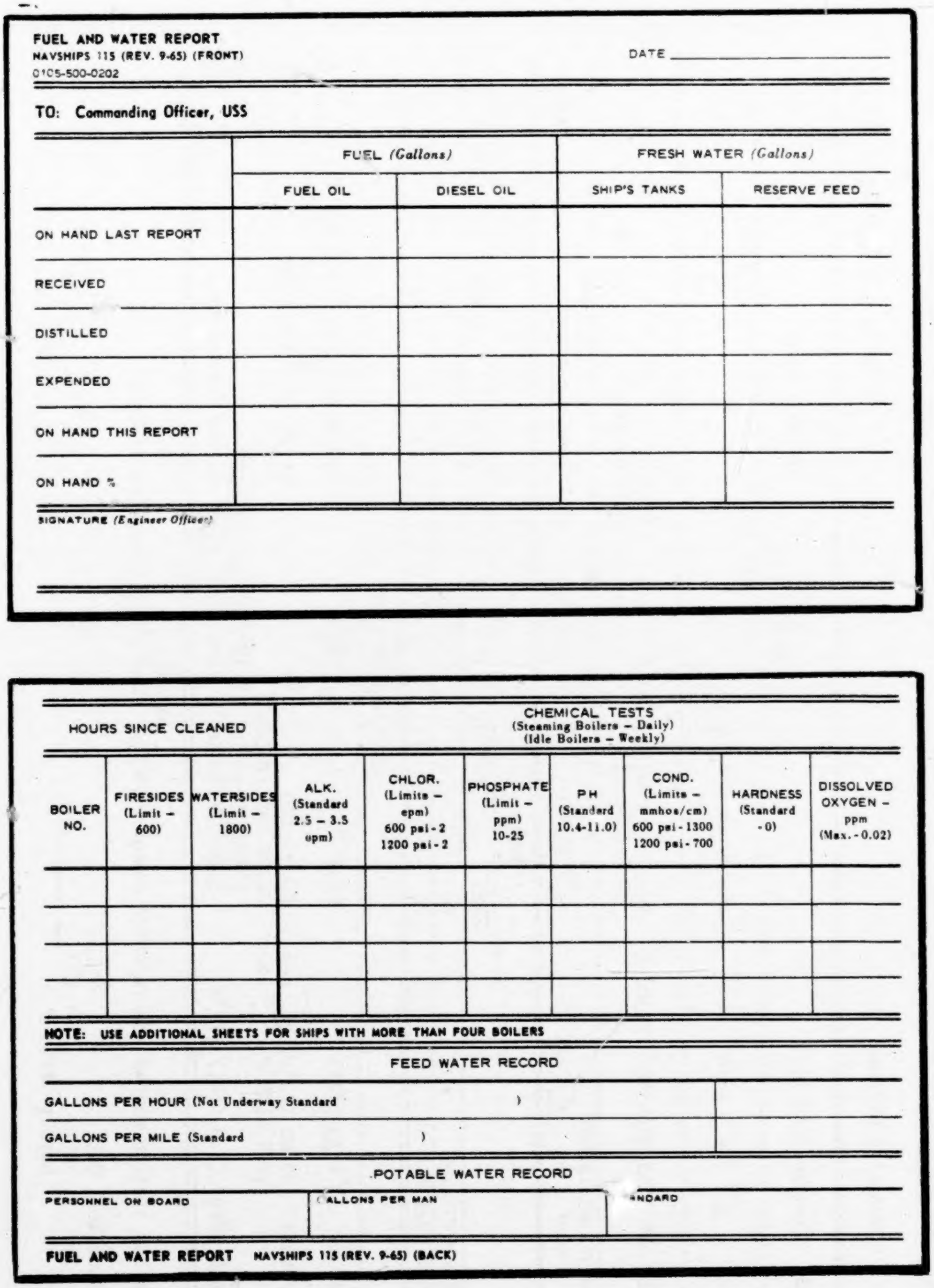
The engineer officer uses a Fueling Memorandum to inform the commanding officer, the OOD, the supply officer, and any others concerned (including the ship fueled, when delivering fuel) whenever fuel oil or diesel oil is received or delivered. A sample Fueling Memorandum is shown in figure 6-10. As much information (as shown on the sample form) as is available and applicable should be supplied by the memorandum.

LIQUID LOAD PLAN

The Liquid Load Plan of the ship is a printed or mimeographed (locally prepared) diagrammatic layout of all ship's tanks with the tanks colored to indicate graphically the approximate status of fuel, ballast water, reserve feed water, and potable water. The plan is prepared and distributed daily by the oil king. Copies serve as important aids to the damage control watch officer, engineer officer, and engineering officer of the watch. In large ships, a copy of the plan may be posted at each repair party control station to provide information to the repair party officers.

BOAT FUELING RECORD

The Boat Fueling Record is a locally prepared, daily record of the fueling of powerboats.



FUEL AND WATER REPORT
NAVSHIPS 115 (REV. 9-65) (FRONT)
0105-500-0202

DATE ______________________

TO: Commanding Officer, USS

	FUEL *(Gallons)*		FRESH WATER *(Gallons)*	
	FUEL OIL	DIESEL OIL	SHIP'S TANKS	RESERVE FEED
ON HAND LAST REPORT				
RECEIVED				
DISTILLED				
EXPENDED				
ON HAND THIS REPORT				
ON HAND %				

SIGNATURE *(Engineer Officer)*

HOURS SINCE CLEANED			CHEMICAL TESTS (Steaming Boilers – Daily) (Idle Boilers – Weekly)							
BOILER NO.	FIRESIDES (Limit – 600)	WATERSIDES (Limit – 1800)	ALK. (Standard 2.5 – 3.5 epm)	CHLOR. (Limits – epm) 600 psi - 2 1200 psi - 2	PHOSPHATE (Limit – ppm) 10-25	PH (Standard 10.4-11.0)	COND. (Limits – mmhos/cm) 600 psi - 1300 1200 psi - 700	HARDNESS (Standard - 0)	DISSOLVED OXYGEN – ppm (Max. - 0.02)

NOTE: USE ADDITIONAL SHEETS FOR SHIPS WITH MORE THAN FOUR BOILERS

FEED WATER RECORD

GALLONS PER HOUR (Not Underway Standard)	
GALLONS PER MILE (Standard)	

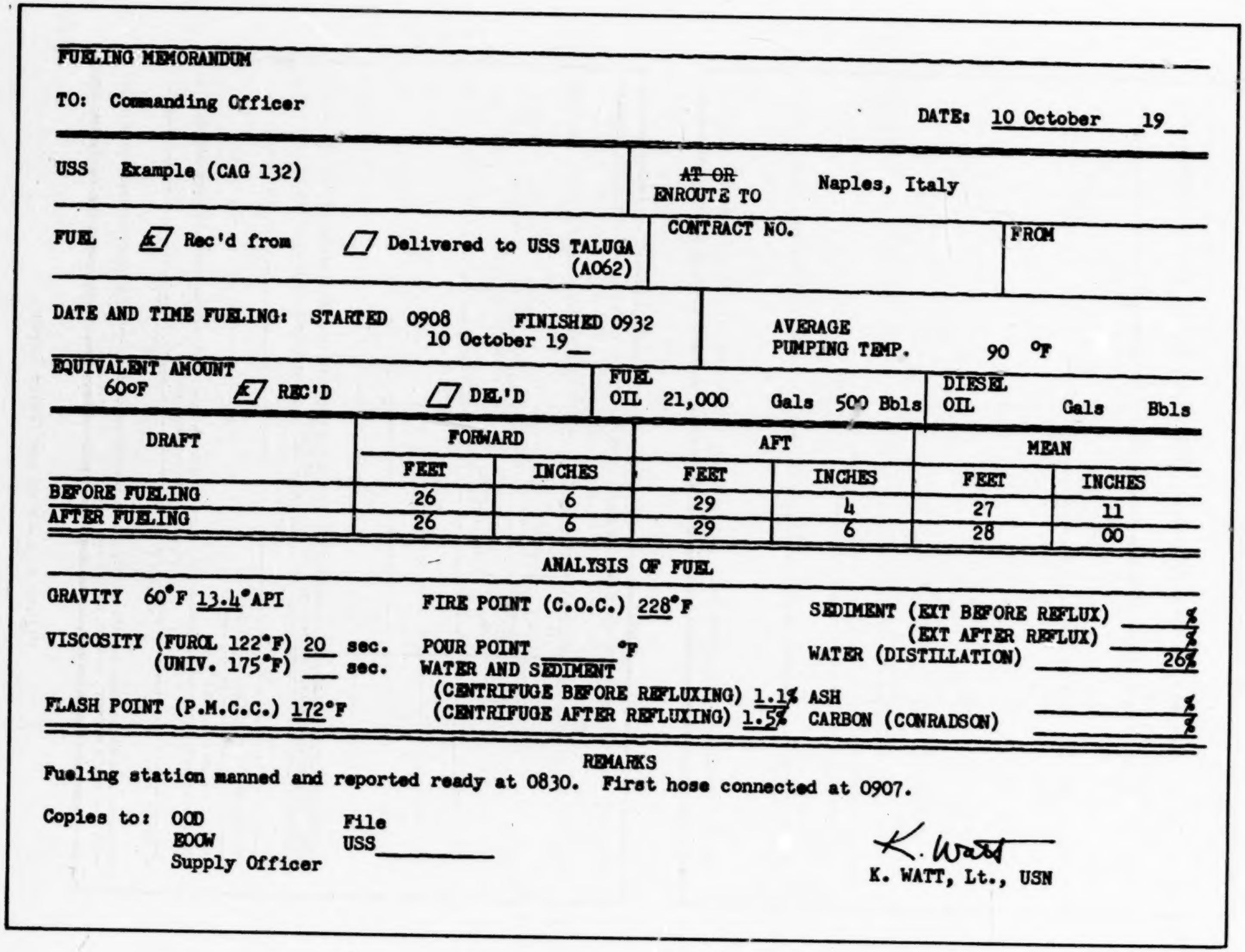
POTABLE WATER RECORD

PERSONNEL ON BOARD	GALLONS PER MAN	ANDARD

FUEL AND WATER REPORT NAVSHIPS 115 (REV. 9-65) (BACK)

98.165

Figure 6-9.—Fuel and Water Report.



FUELING MEMORANDUM

TO: Commanding Officer

DATE: 10 October 19__

USS Example (CAG 132)

~~AT OR~~ ENROUTE TO Naples, Italy

FUEL ☒ Rec'd from ☐ Delivered to USS TALUGA (AO62)

CONTRACT NO.

FROM

DATE AND TIME FUELING: STARTED 0908 FINISHED 0932 10 October 19__

AVERAGE PUMPING TEMP. 90 °F

EQUIVALENT AMOUNT 60oF ☒ REC'D ☐ DEL'D

FUEL OIL 21,000 Gals 500 Bbls

DIESEL OIL Gals Bbls

DRAFT	FORWARD		AFT		MEAN	
	FEET	INCHES	FEET	INCHES	FEET	INCHES
BEFORE FUELING	26	6	29	4	27	11
AFTER FUELING	26	6	29	6	28	00

ANALYSIS OF FUEL

GRAVITY 60°F 13.4°API

VISCOSITY (FUROL 122°F) 20 sec.

(UNIV. 175°F) ___ sec.

FLASH POINT (P.M.C.C.) 172°F

FIRE POINT (C.O.C.) 228°F

POUR POINT ______ °F

WATER AND SEDIMENT

(CENTRIFUGE BEFORE REFLUXING) 1.1%

(CENTRIFUGE AFTER REFLUXING) 1.5%

SEDIMENT (EXT BEFORE REFLUX) ______ %

(EXT AFTER REFLUX) ______ %

WATER (DISTILLATION) ______ 26%

ASH ______ %

CARBON (CONRADSON) ______ %

REMARKS

Fueling station manned and reported ready at 0830. First hose connected at 0907.

Copies to: OOD
EOOW
Supply Officer
File
USS________

K. Watt
K. WATT, Lt., USN

Figure 6-10.—A sample fueling memorandum.

114.12

116

It is an indispensable record for ships carrying or maintaining a large number of boats. All operating boats should be fueled daily prior to 0800 in order to prevent the necessity of fueling at unusual hours and to ensure readiness for unscheduled calls. The record for each boat should indicate (1) the boat number, (2) fuel capacity of the boat in gallons, (3) fuel on hand, (4) approximate fuel consumption in gallons per hour, and (5) whether or not the boat was fueled to capacity.

OIL KING'S MEMORANDUM

The Oil King's Memorandum is a locally prepared report of the fuel oil and feed water suction and standby tanks. It is submitted as of 1000 and 2000, to the engineer officer (copy to the engineering officer of the watch). The report is prepared by the oil king and includes soundings of all reserve feed water tanks by each watch. The report is primarily for large ships, but it is useful for keeping any ship's engineer officer and engineering officer of the watch informed of the status of the fuel and feed water.

MONTHLY SUMMARY

The Monthly Summary of Fuel Inventory and Steaming Hours Report, NavShips 5083, is shown in figure 6-11. The purpose of this report is to provide the Naval Ship Systems Command with a monthly summary of information on the ship's fuel inventory, the ship's fuel consumption, and on the steaming hours. This report contains all data as of 2400 of the last day of the previous month and shall be forwarded within five (5) days of completion of the reporting period. This report consists of one original copy and three carbon copies. The original copy is sent to the Naval Ship Systems Command, one carbon copy to the type commander, one carbon copy to the squadron commander (division commander for cruisers and carriers), and the last carbon copy is filed aboard ship.

The Monthly Summary provides current and cumulative data necessary for determining budget and fleet logistic requirements and operational performance. Information sheets containing detailed instructions for completing the forms are issued with the forms. The back of the report contains spaces for recording data concerning the ship's displacement, number of days out of dock, number of days assigned uninterrupted upkeep periods or availabilities, and the number of hours underway at various speeds. Space is also provided on the back of the report for general remarks and the signatures of the engineer officer and commanding officer.

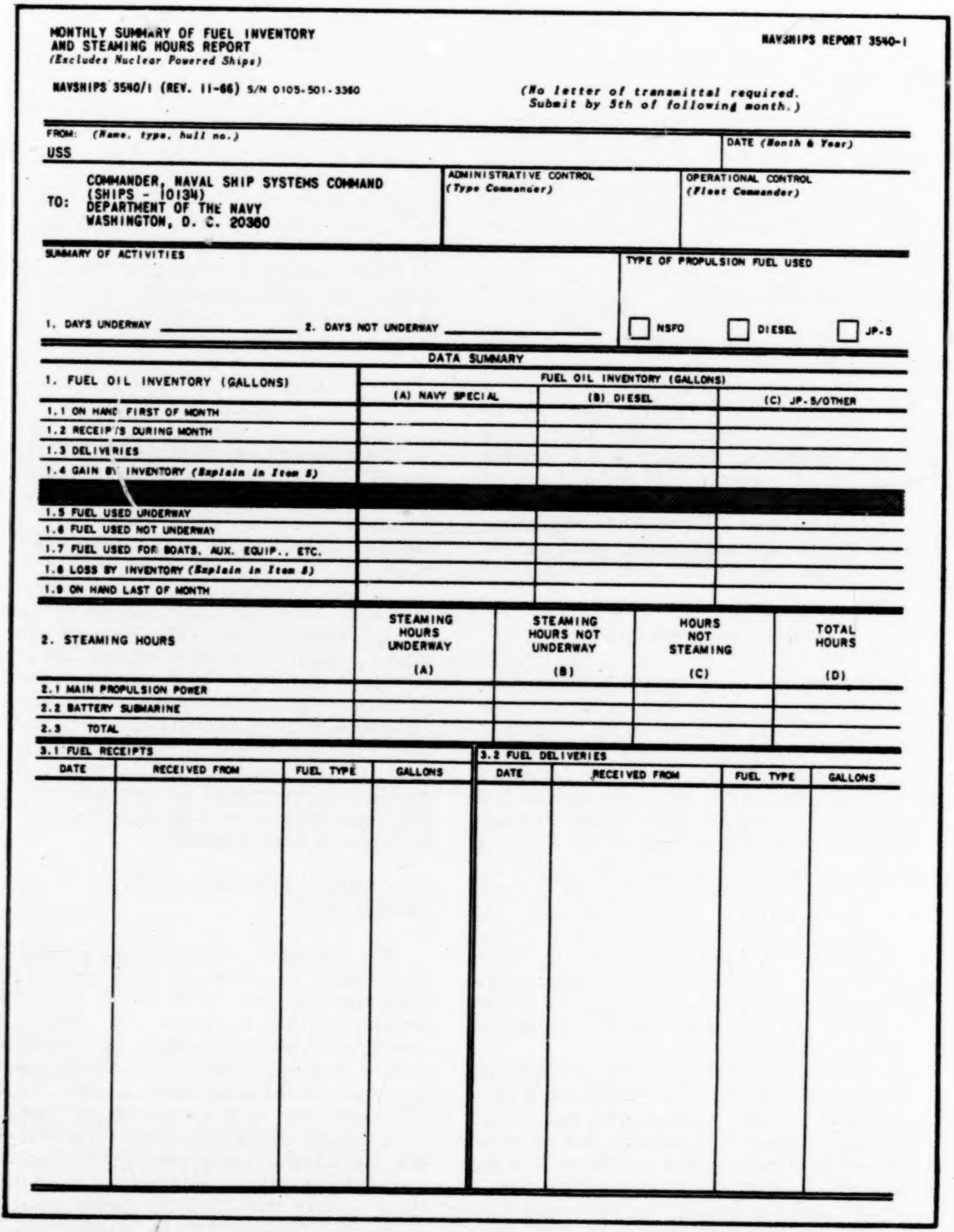
Most engineer officers prefer to compile the necessary data for this summary on a daily basis rather than wait until the end of the month and make computations from the various records. In using either method, care must be taken to correctly compute and record the data on the Monthly Summary in order to avoid having to submit a corrected form at a later date.

MISCELLANEOUS RECORDS AND REPORTS

The engineering records and reports discussed in this section serve to inform responsible personnel of coming events (including impending casualties), supply data for the analysis of equipment performance, provide a basis for design comparison and improvement, or provide information for the improvement of maintenance techniques and the development of new work methods. The records are those papers required to be compiled and retained on board (in original or duplicate form) for prescribed periods of time, primarily for reference in administrative and operational matters. The reports are of either a one-time or recurring nature. Recurring reports are required at prescribed or set intervals while one-time reports need be made only on the occurrence of a given situation.

ENGINEER OFFICER'S NIGHT ORDER BOOK

The engineer officer keeps a Night Order Book which is preserved as a part of the engineering records and in which is entered the engineer officer's orders with respect to (1) operation of the engineering plant, (2) any special orders or precautions concerning the speed and operation of the main engines, and (3) all other orders for the night for the engineering officer of the watch. The Night Order Book is prepared and maintained in accordance with instructions issued by the type commander. Some instructions specify that the Night Order Book utilize a specific format that is standard for ships of the type while other commands allow use



MONTHLY SUMMARY OF FUEL INVENTORY
AND STEAMING HOURS REPORT
(Excludes Nuclear Powered Ships)

NAVSHIPS REPORT 3540-1

NAVSHIPS 3540/1 (REV. 11-66) S/N 0105-501-3360

(No letter of transmittal required.
Submit by 5th of following month.)

FROM: *(Name, type, hull no.)*
USS

DATE *(Month & Year)*

TO: COMMANDER, NAVAL SHIP SYSTEMS COMMAND
(SHIPS - 10134)
DEPARTMENT OF THE NAVY
WASHINGTON, D. C. 20360

ADMINISTRATIVE CONTROL
(Type Commander)

OPERATIONAL CONTROL
(Fleet Commander)

SUMMARY OF ACTIVITIES

1. DAYS UNDERWAY ____________ 2. DAYS NOT UNDERWAY ____________

TYPE OF PROPULSION FUEL USED

☐ NSFO ☐ DIESEL ☐ JP-5

DATA SUMMARY

1. FUEL OIL INVENTORY (GALLONS)	FUEL OIL INVENTORY (GALLONS)		
	(A) NAVY SPECIAL	(B) DIESEL	(C) JP-5/OTHER
1.1 ON HAND FIRST OF MONTH			
1.2 RECEIPTS DURING MONTH			
1.3 DELIVERIES			
1.4 GAIN BY INVENTORY *(Explain in Item 5)*			
1.5 FUEL USED UNDERWAY			
1.6 FUEL USED NOT UNDERWAY			
1.7 FUEL USED FOR BOATS, AUX. EQUIP., ETC.			
1.8 LOSS BY INVENTORY *(Explain in Item 5)*			
1.9 ON HAND LAST OF MONTH			

2. STEAMING HOURS	STEAMING HOURS UNDERWAY (A)	STEAMING HOURS NOT UNDERWAY (B)	HOURS NOT STEAMING (C)	TOTAL HOURS (D)
2.1 MAIN PROPULSION POWER				
2.2 BATTERY SUBMARINE				
2.3 TOTAL				

3.1 FUEL RECEIPTS

DATE	RECEIVED FROM	FUEL TYPE	GALLONS

3.2 FUEL DELIVERIES

DATE	RECEIVED FROM	FUEL TYPE	GALLONS

147.169

Figure 6-11.—Monthly summary of Fuel Inventory and Steaming Hours Report.

of a locally prepared (mimeographed) form but specify certain contents of the book.

The engineer officer's Night Order Book must contain orders covering routine situations of a recurring nature (engineering department standing night orders) as well as orders for the night for the engineering officer of the watch. Standing night orders are issued by the engineer officer as a letter type directive (instruction), in accordance with the ship's directives system; and a copy of the instruction is posted in the front of the Night Order Book. Orders for the night for the engineering officer of the watch generally specify the boilers and other major items of machinery to be used during the night watches. A form similar to the one illustrated in figure 6-12 is in use in some ships for the issuance of the engineer officer's night orders.

The Night Order Book is maintained in port and at sea. In the temporary absence of the engineer officer in port, the book may be maintained by the engineering department duty officer. Underway, the Night Order Book is delivered to the engineering officer of the watch prior to 2000 and is returned to the log room prior to 0800 of the following day. In addition to the engineering officer of the watch, principal engineering watch supervisors, and the oil king should read and initial the night orders for the watch. In port, the night orders should be read and initialed by the leading duty petty officer of each engineering division as well as by the principal watch supervisors.

STEAMING ORDERS

Steaming Orders are written orders issued by the engineer officer that list the major machinery units and readiness requirements of the engineering department based upon the time set for getting the ship underway. Generally, a locally prepared form similar to the one illustrated in figure 6-13 is used for issuance of the Steaming Orders. The orders normally specify (1) the engine combinations to be used, (2) times for lighting fires and cutting-in boilers, (3) times for warming up and testing main engines, (4) times for starting and paralleling ship's service generators, (5) standard speed, and (6) engineering officer of the watch and principal watch supervisors. Early posting of Steaming Orders is essential to getting a ship with a large engineering plant underway with a minimum of confusion.

GYROCOMPASS SERVICE RECORD BOOK

The Gyrocompass Service Record Book, NavShips 708, is furnished the ship with each gyrocompass (except the Mk 22) installed. The book is a complete record of inspections, tests, and repairs to the gyrocompass and must always remain with its associated gyrocompass. Complete instructions for maintaining the record are outlined in the front of the book and must be carefully followed. In the event of loss of—or damage to—the gyrocompass service record book, a replacement book can be obtained as indicated in the Navy Stock List of Forms and Publications, NavSup 2002. The requisition for the new book must show the mark, modification, and serial numbers of the gyrocompass for which the book is intended.

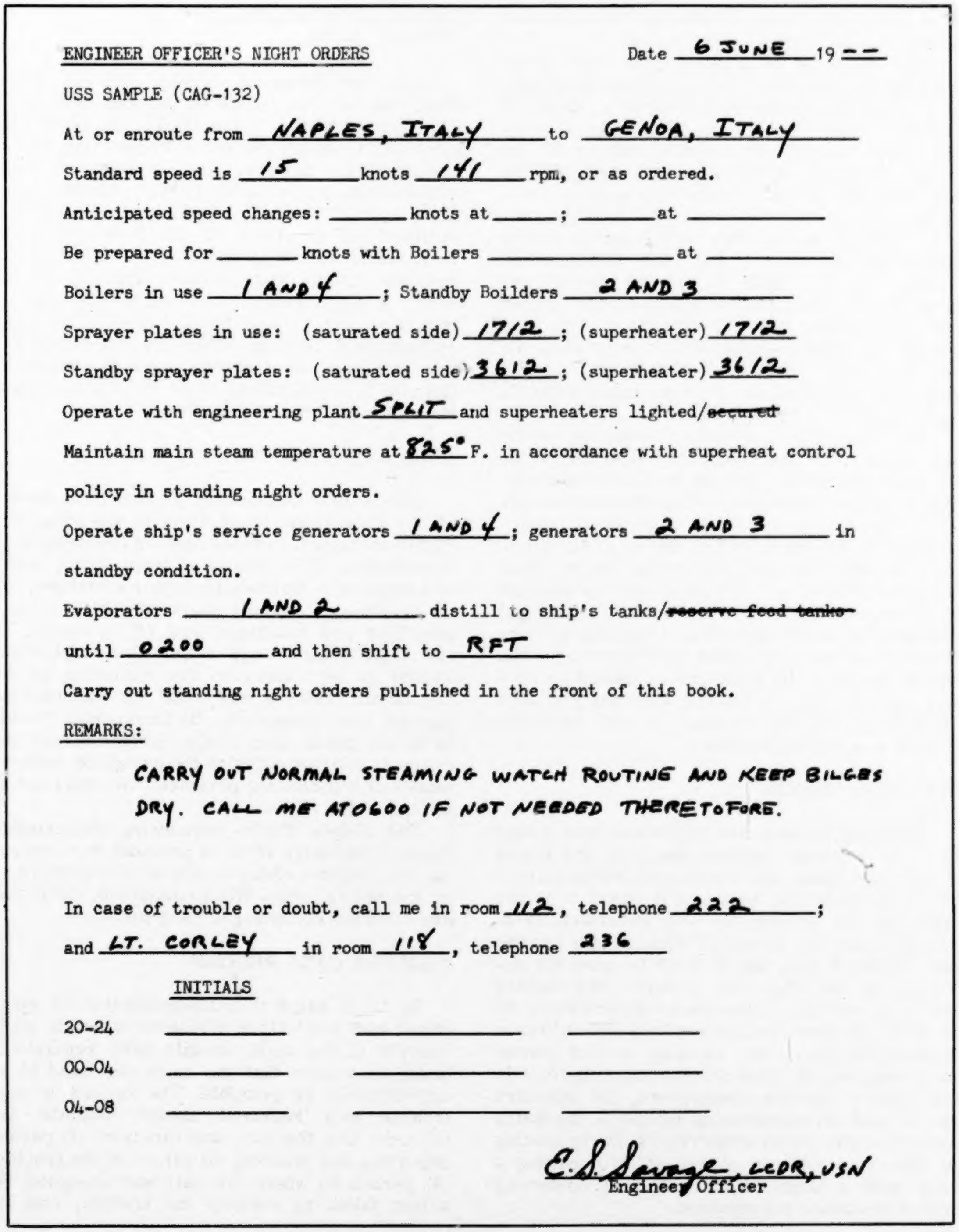
DEGAUSSING FOLDER

The ship's Degaussing Folder is a record of the degaussing installation in the ship. The folder contains (1) a description of the degaussing installation; (2) a record of inspections, tests, and repairs performed by repair activities; (3) the values of all coil currents for the ship's positions and headings; and (4) a record of the degaussing range runs. The Degaussing Folder is necessary to the operation of the degaussing system and must be safeguarded against loss. Generally, the Degaussing Folder is in the possession of the navigator; and the engineer officer provides the navigator with the names of engineering personnel who will require access to the folder.

The Ship's Force Degaussing Maintenance Record, NavShips 1009, is provided for recording maintenance of degaussing system performed by the ship's force. When completed, the forms are inserted in the degaussing folder.

TROUBLE CALL RECORD

In large ships it is advisable that the electrical and auxiliaries divisions maintain daily records of the many trouble calls received in order to ensure that the calls are handled as expeditiously as possible. The record of each trouble call received should indicate the (1) time that the call was received, (2) person reporting the trouble, (3) nature of the trouble, (4) person to whom the call was assigned, (5) action taken to correct the trouble, and (6)



ENGINEER OFFICER'S NIGHT ORDERS Date 6 JUNE 19 --

USS SAMPLE (CAG-132)

At or enroute from NAPLES, ITALY to GENOA, ITALY

Standard speed is 15 knots 141 rpm, or as ordered.

Anticipated speed changes: ______ knots at ______; ______ at ______

Be prepared for ______ knots with Boilers ______ at ______

Boilers in use 1 AND 4; Standby Boilders 2 AND 3

Sprayer plates in use: (saturated side) 1712; (superheater) 1712

Standby sprayer plates: (saturated side) 3612; (superheater) 3612

Operate with engineering plant SPLIT and superheaters lighted/~~secured~~

Maintain main steam temperature at 825° F. in accordance with superheat control policy in standing night orders.

Operate ship's service generators 1 AND 4; generators 2 AND 3 in standby condition.

Evaporators 1 AND 2 distill to ship's tanks/~~reserve feed tanks~~ until 0200 and then shift to RFT

Carry out standing night orders published in the front of this book.

REMARKS:

CARRY OUT NORMAL STEAMING WATCH ROUTINE AND KEEP BILGES DRY. CALL ME AT 0600 IF NOT NEEDED THERETOFORE.

In case of trouble or doubt, call me in room 112, telephone 222;

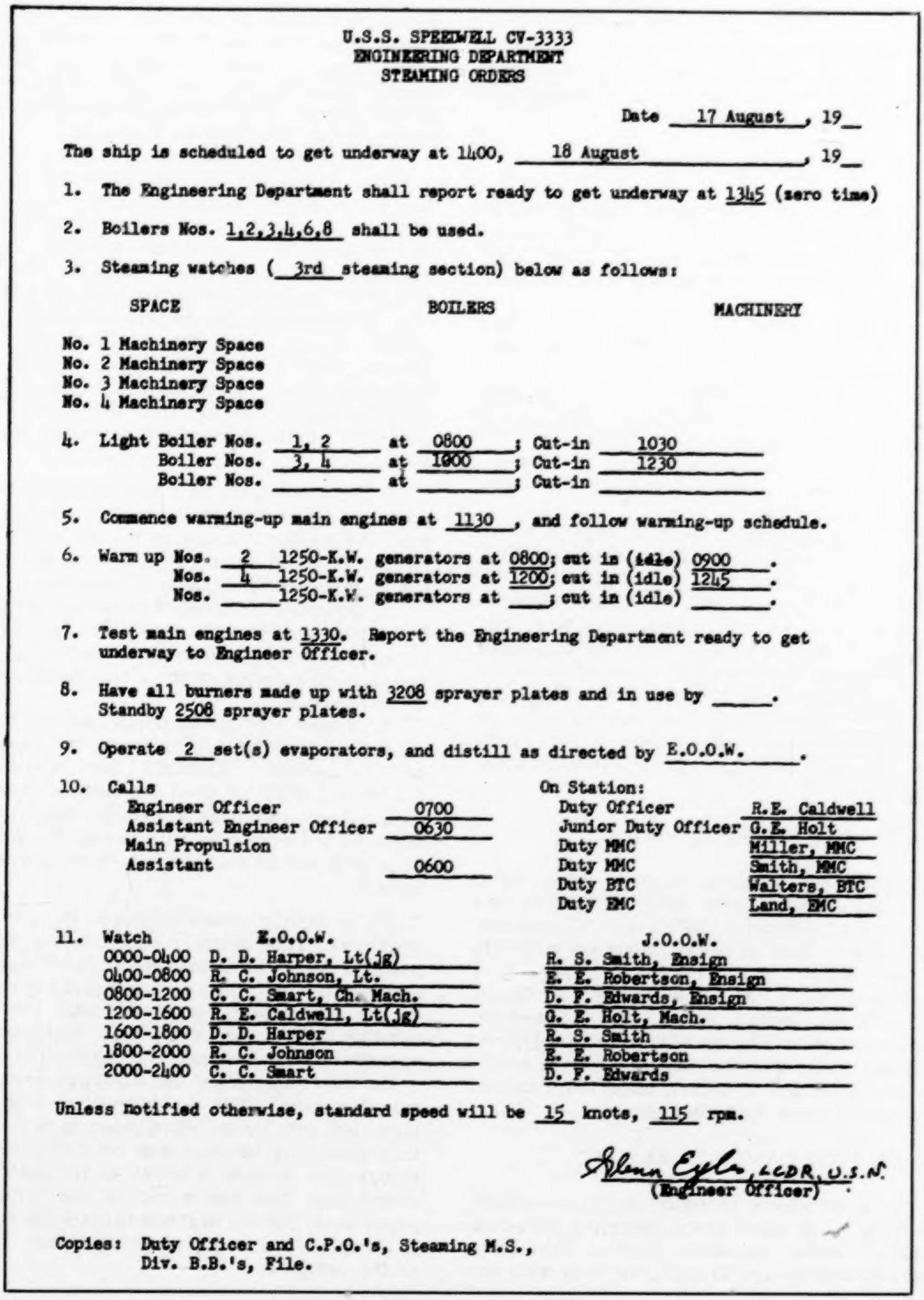
and LT. CORLEY in room 118, telephone 236

INITIALS

20-24			
00-04			
04-08			

E. S. Savage, LCDR, USN
Engineer Officer

Figure 6-12.—A sample of the engineer officer's night orders. 114.13



U.S.S. SPEEDWELL CV-3333
ENGINEERING DEPARTMENT
STEAMING ORDERS

Date 17 August , 19__

The ship is scheduled to get underway at 1400, 18 August , 19__

1. The Engineering Department shall report ready to get underway at 1345 (zero time)

2. Boilers Nos. 1,2,3,4,6,8 shall be used.

3. Steaming watches (3rd steaming section) below as follows:

SPACE	BOILERS	MACHINERY
No. 1 Machinery Space		
No. 2 Machinery Space		
No. 3 Machinery Space		
No. 4 Machinery Space		

4. Light Boiler Nos. 1, 2 at 0800 ; Cut-in 1030
Boiler Nos. 3, 4 at 1000 ; Cut-in 1230
Boiler Nos. ______ at ______ ; Cut-in ______

5. Commence warming-up main engines at 1130 , and follow warming-up schedule.

6. Warm up Nos. 2 1250-K.W. generators at 0800; cut in (idle) 0900 .
Nos. 4 1250-K.W. generators at 1200; cut in (idle) 1245 .
Nos. ____ 1250-K.W. generators at ___ ; cut in (idle) ______ .

7. Test main engines at 1330. Report the Engineering Department ready to get underway to Engineer Officer.

8. Have all burners made up with 3208 sprayer plates and in use by _____ .
Standby 2508 sprayer plates.

9. Operate 2 set(s) evaporators, and distill as directed by E.O.O.W. .

10. Calls

Engineer Officer	0700
Assistant Engineer Officer	0630
Main Propulsion Assistant	0600

On Station:

Duty Officer	R.E. Caldwell
Junior Duty Officer	G.E. Holt
Duty MMC	Miller, MMC
Duty MMC	Smith, MMC
Duty BTC	Walters, BTC
Duty EMC	Land, EMC

11.

Watch	E.O.O.W.	J.O.O.W.
0000-0400	D. D. Harper, Lt(jg)	R. S. Smith, Ensign
0400-0800	R. C. Johnson, Lt.	E. E. Robertson, Ensign
0800-1200	C. C. Smart, Ch. Mach.	D. F. Edwards, Ensign
1200-1600	R. E. Caldwell, Lt(jg)	G. E. Holt, Mach.
1600-1800	D. D. Harper	R. S. Smith
1800-2000	R. C. Johnson	E. E. Robertson
2000-2400	C. C. Smart	D. F. Edwards

Unless notified otherwise, standard speed will be 15 knots, 115 rpm.

Glenn Eyle, LCDR, U.S.N.
(Engineer Officer)

Copies: Duty Officer and C.P.O.'s, Steaming M.S.,
Div. B.B.'s, File.

114.14

Figure 6-13.—Sample steaming orders.

the time that the trouble was corrected. Division officers should check the record daily to ensure that all calls are answered. The record also provides information as to the existence of unusual maintenance problems.

BOILER WATER TREATMENT LOGS

The Boiler Water Treatment Logs shown in figures 6-14, 6-15, and 6-16 are used to record boiler water tests and treatment. These logs are listed below by name and the type ship they are used on:

1. Boiler Water Treatment Log - Navy Boiler Compound, NavShips 9560/1, for ships with 600 psi boilers and below.
2. Boiler Water Treatment Log - High Phosphate Treatment, NavShips 9560/2, for ships with diatomite feedwater filters.
3. Boiler Water Treatment Log - Low Phosphate Treatment, NavShips 9560/3, for ships with 1200 psi boilers.

The Feedwater Log, NavShips 9560/4, shown in figure 6-17, is used for feedwater tests on all ships with propulsion and auxiliary boilers. The Feedwater Log, along with one of the previous logs listed will be used on each ship to record the tests of feedwater and tests and treatment of boiler water. Figures 6-16 and 6-17 illustrate the proper method for entering data to the logs.

Specific instructions for entering data in these logs are given in the Boiler Water/Feedwater Test and Treatment Course (certification course).

BOILER TUBE RENEWAL SHEETS

Boiler Tube Renewal Sheets, often called Boiler Tube Data Sheets, should be used to keep a record of defective tubes and of renewed tubes. Boiler Tube Renewal Sheets are available for most boilers now in naval use. Figure 6-18 illustrates this form for a Babcock & Wilcox double-furnace boiler; figure. 16-19 shows the form for a Foster Wheeler single-furnace boiler. If Boiler Tube Renewal Sheets are not available for a particular boiler, similar forms can be prepared from the boiler plans.

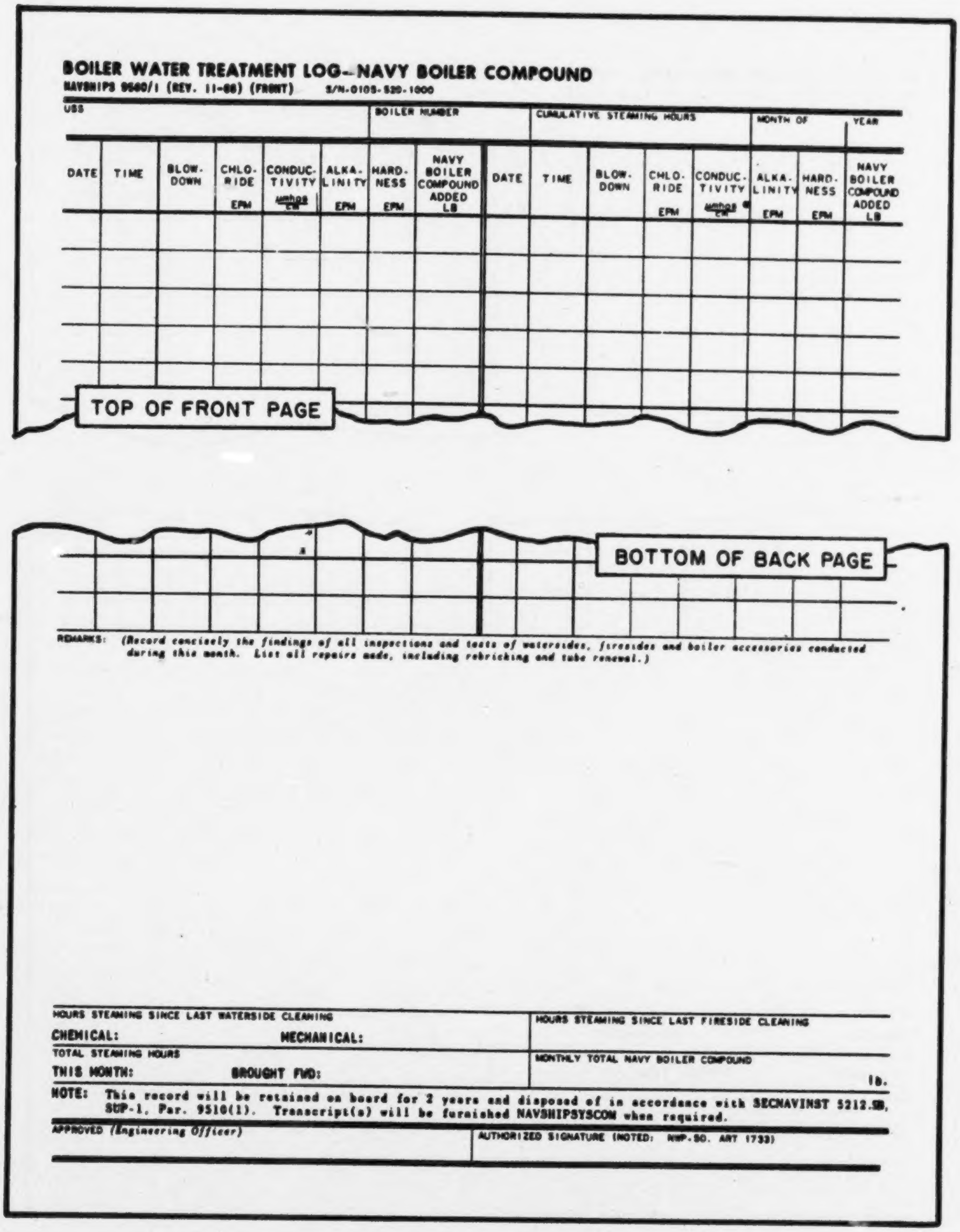
BOILER TUBE CASUALTY REPORT

The form shown in figure 6-20 is a standard form to be used when reporting failed or replaced boiler pressure parts. This form (Form 4ND-Shipyard 9510/2), together with any required samples of deposits, tubes, and boiler water, should be forwarded to the Naval Ships Engineering Center, Philadelphia Division (formerly Naval Boiler and Turbine Laboratory), in accordance with current instructions issued by the Naval Ship Systems Command.

It is essential that standard terminology be used in filling out the Boiler Tube Casualty Report to provide meaningful information on the nature and causes of the damage. If trouble is encountered in determining the exact type of damage, remember that (1) the term RUPTURE should be used for all openings associated with tube enlargement; (2) the term PERFORATION should be used only for openings other than cracks which are not associated with tube enlargement; and (3) the term CRACK should be used for longitudinal or circumferential separation where there is no appreciable tube enlargement.

If it is necessary to submit samples in connection with boiler pressure part damage, current instructions issued by the Naval Ship Systems Command should be followed. Here are a few tips on the submission of samples:

1. Samples of damaged pressure parts must be obtained as nearly as possible in their original form. A complete tube section containing a representative example of the metal damage makes a good sample.
2. Tubes sent as samples may be cut into convenient lengths for shipping, but they must be CLEARLY MARKED for reassembly. Oil should NOT be used for cutting a tube that is to be submitted as a sample. Sample tubes must be cut very carefully so that the damaged area will not be cut, burned, or otherwise disfigured.
3. A poorly labeled sample is practically worthless. Tube sections should be marked with paint to show the side toward the furnace, the steam drum end, the relationship of each section to the other sections of the tube, the boiler number, the name of the ship, and any other necessary information. The marking must not cover or contaminate the damaged area. Tube samples must NOT be submitted with paper tags tied onto them; when paper tags are used, they generally become lost or disfigured long before the sample arrives at its destination. Metal tags that are wired on are better than paper tags, but the best way to mark the samples is to give the required information directly on the samples.



BOILER WATER TREATMENT LOG—NAVY BOILER COMPOUND
NAVSHIPS 9560/1 (REV. 11-66) (FRONT) S/N-0105-520-1000

USS
BOILER NUMBER
CUMULATIVE STEAMING HOURS
MONTH OF
YEAR

DATE	TIME	BLOW-DOWN	CHLORIDE EPM	CONDUCTIVITY µmhos/cm	ALKALINITY EPM	HARDNESS EPM	NAVY BOILER COMPOUND ADDED LB	DATE	TIME	BLOW-DOWN	CHLORIDE EPM	CONDUCTIVITY µmhos/cm	ALKALINITY EPM	HARDNESS EPM	NAVY BOILER COMPOUND ADDED LB

TOP OF FRONT PAGE

BOTTOM OF BACK PAGE

REMARKS: *(Record concisely the findings of all inspections and tests of watersides, firesides and boiler accessories conducted during this month. List all repairs made, including rebricking and tube renewal.)*

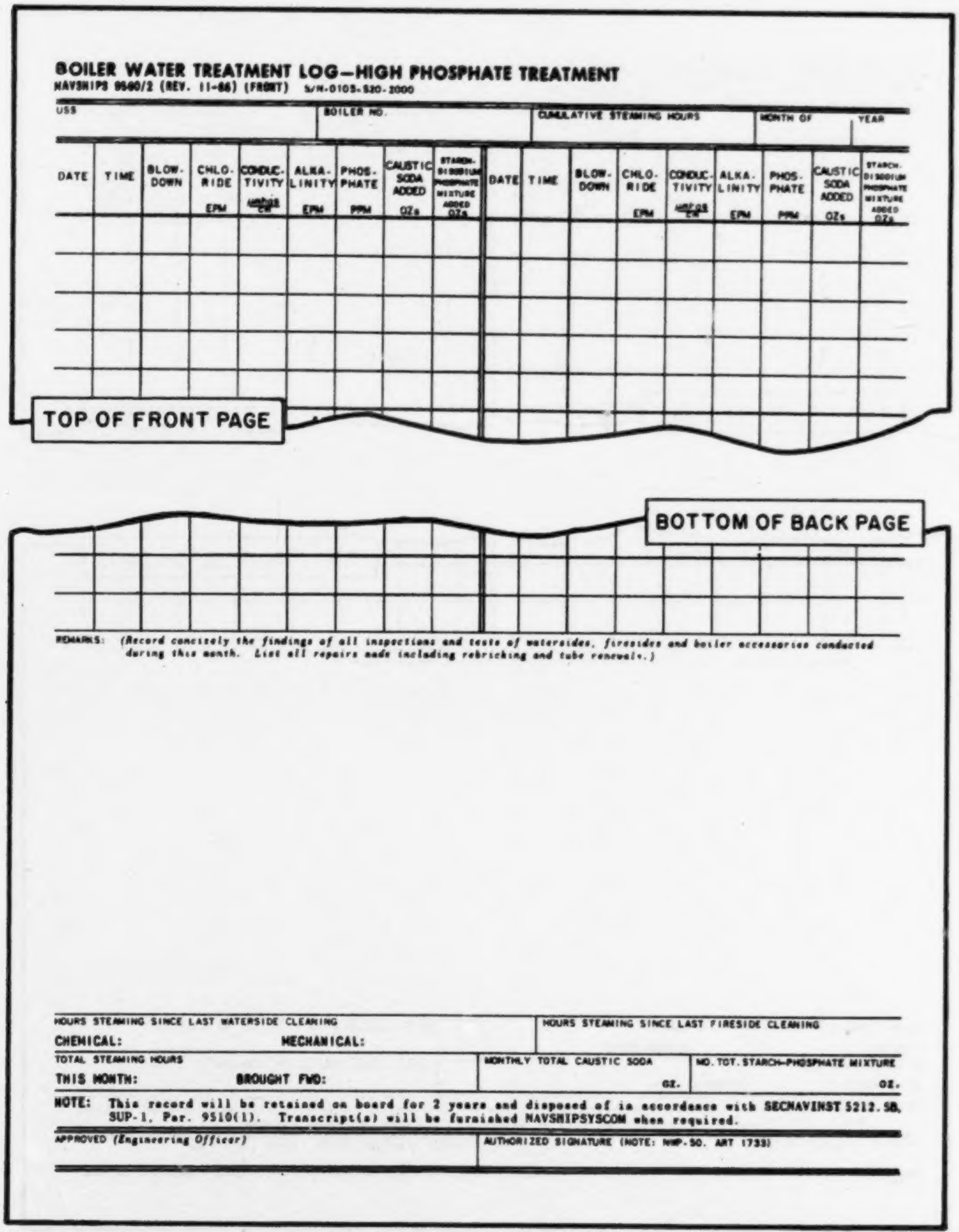
HOURS STEAMING SINCE LAST WATERSIDE CLEANING
CHEMICAL: MECHANICAL:
HOURS STEAMING SINCE LAST FIRESIDE CLEANING
TOTAL STEAMING HOURS
THIS MONTH: BROUGHT FWD:
MONTHLY TOTAL NAVY BOILER COMPOUND lb.

NOTE: This record will be retained on board for 2 years and disposed of in accordance with SECNAVINST 5212.5B, SUP-1, Par. 9510(1). Transcript(s) will be furnished NAVSHIPSYSCOM when required.

APPROVED *(Engineering Officer)*
AUTHORIZED SIGNATURE (NOTED: NWP-50. ART 1733)

98.164.1

Figure 6-14.—Boiler Water Treatment Log—Navy Boiler Compound.



BOILER WATER TREATMENT LOG—HIGH PHOSPHATE TREATMENT
NAVSHIPS 9560/2 (REV. 11-66) (FRONT) S/N-0105-520-2000

USS	BOILER NO.	CUMULATIVE STEAMING HOURS	MONTH OF	YEAR

DATE	TIME	BLOW-DOWN	CHLORIDE EPM	CONDUCTIVITY µMHOS/CM	ALKALINITY EPM	PHOSPHATE PPM	CAUSTIC SODA ADDED OZs	STARCH-DISODIUM PHOSPHATE MIXTURE ADDED OZs	DATE	TIME	BLOW-DOWN	CHLORIDE EPM	CONDUCTIVITY µMHOS/CM	ALKALINITY EPM	PHOSPHATE PPM	CAUSTIC SODA ADDED OZs	STARCH-DISODIUM PHOSPHATE MIXTURE ADDED OZs

TOP OF FRONT PAGE

BOTTOM OF BACK PAGE

REMARKS: *(Record concisely the findings of all inspections and tests of watersides, firesides and boiler accessories conducted during this month. List all repairs made including rebricking and tube renewals.)*

HOURS STEAMING SINCE LAST WATERSIDE CLEANING
CHEMICAL: MECHANICAL:

HOURS STEAMING SINCE LAST FIRESIDE CLEANING

TOTAL STEAMING HOURS
THIS MONTH: BROUGHT FWD:

MONTHLY TOTAL CAUSTIC SODA OZ.

MO. TOT. STARCH-PHOSPHATE MIXTURE OZ.

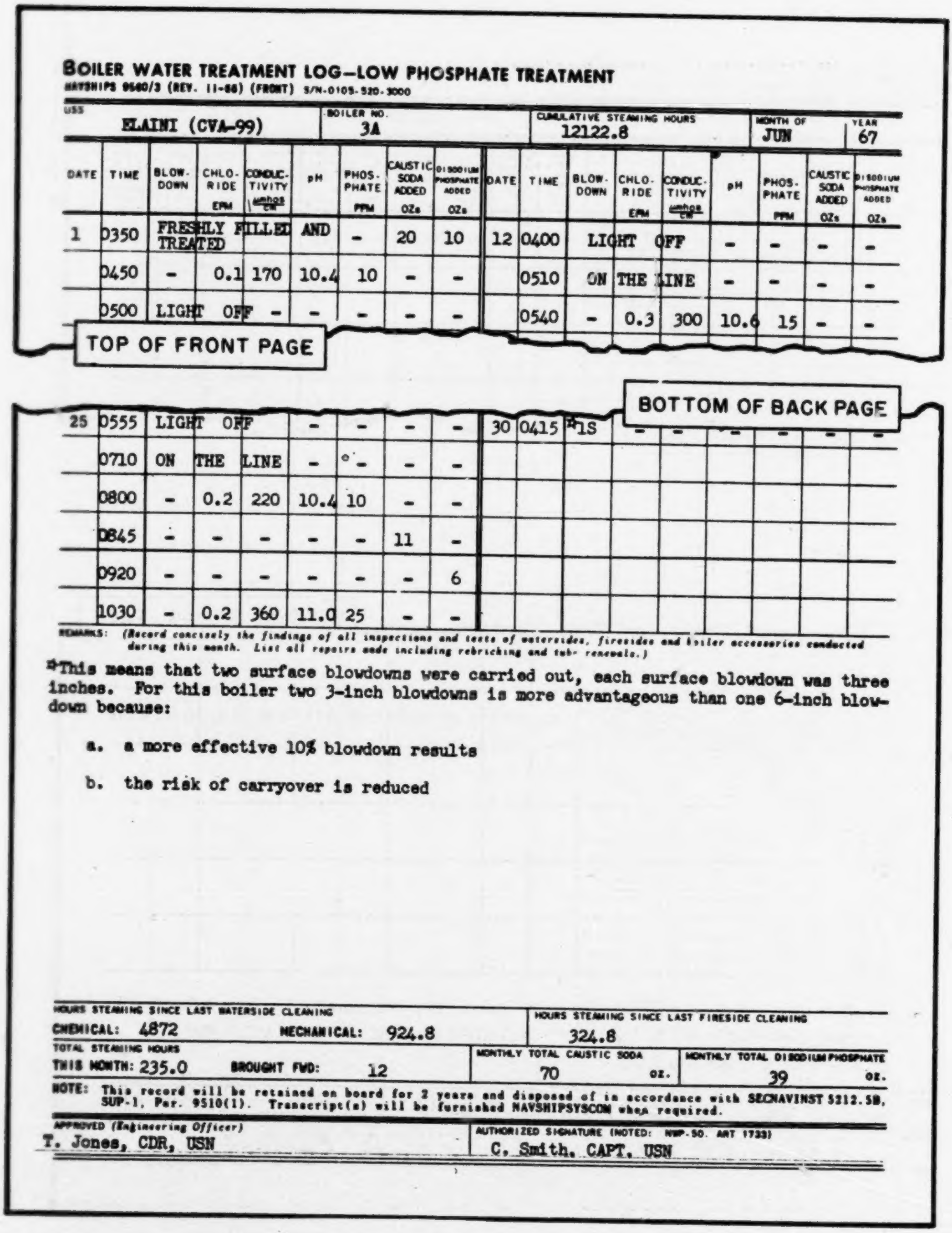
NOTE: This record will be retained on board for 2 years and disposed of in accordance with SECNAVINST 5212.5B, SUP-1, Par. 9510(1). Transcript(s) will be furnished NAVSHIPSYSCOM when required.

APPROVED *(Engineering Officer)*

AUTHORIZED SIGNATURE (NOTE: NWP-50. ART 1733)

98.164.2

Figure 6-15.—Boiler Water Treatment Log—High Phosphate Treatment.



BOILER WATER TREATMENT LOG—LOW PHOSPHATE TREATMENT
NAVSHIPS 9560/3 (REV. 11-66) (FRONT) S/N-0105-520-3000

USS	BOILER NO.	CUMULATIVE STEAMING HOURS	MONTH OF	YEAR
ELAINI (CVA-99)	3A	12122.8	JUN	67

DATE	TIME	BLOW-DOWN	CHLORIDE EPM	CONDUCTIVITY µmhos/cm	pH	PHOSPHATE PPM	CAUSTIC SODA ADDED OZs	DISODIUM PHOSPHATE ADDED OZs	DATE	TIME	BLOW-DOWN	CHLORIDE EPM	CONDUCTIVITY µmhos/cm	pH	PHOSPHATE PPM	CAUSTIC SODA ADDED OZs	DISODIUM PHOSPHATE ADDED OZs
1	0350	FRESHLY FILLED AND TREATED				-	20	10	12	0400	LIGHT OFF			-	-	-	-
	0450	-	0.1	170	10.4	10	-	-		0510	ON THE LINE			-	-	-	-
	0500	LIGHT OFF		-	-	-	-	-		0540	-	0.3	300	10.6	15	-	-

TOP OF FRONT PAGE

BOTTOM OF BACK PAGE

DATE	TIME	BLOW-DOWN	CHLORIDE EPM	CONDUCTIVITY µmhos/cm	pH	PHOSPHATE PPM	CAUSTIC SODA ADDED OZs	DISODIUM PHOSPHATE ADDED OZs	DATE	TIME	BLOW-DOWN	CHLORIDE EPM	CONDUCTIVITY µmhos/cm	pH	PHOSPHATE PPM	CAUSTIC SODA ADDED OZs	DISODIUM PHOSPHATE ADDED OZs
25	0555	LIGHT OFF			-	-	-	-	30	0415	*1S	-	-	-	-	-	-
	0710	ON THE LINE			-	-	-	-									
	0800	-	0.2	220	10.4	10	-	-									
	0845	-	-	-	-	-	11	-									
	0920	-	-	-	-	-	-	6									
	1030	-	0.2	360	11.0	25	-	-									

REMARKS: *(Record concisely the findings of all inspections and tests of watersides, firesides and boiler accessories conducted during this month. List all repairs made including rebricking and tube renewals.)*

*This means that two surface blowdowns were carried out, each surface blowdown was three inches. For this boiler two 3-inch blowdowns is more advantageous than one 6-inch blowdown because:

a. a more effective 10% blowdown results

b. the risk of carryover is reduced

HOURS STEAMING SINCE LAST WATERSIDE CLEANING
CHEMICAL: 4872 MECHANICAL: 924.8

HOURS STEAMING SINCE LAST FIRESIDE CLEANING
324.8

TOTAL STEAMING HOURS
THIS MONTH: 235.0 BROUGHT FWD: 12

MONTHLY TOTAL CAUSTIC SODA
70 oz.

MONTHLY TOTAL DISODIUM PHOSPHATE
39 oz.

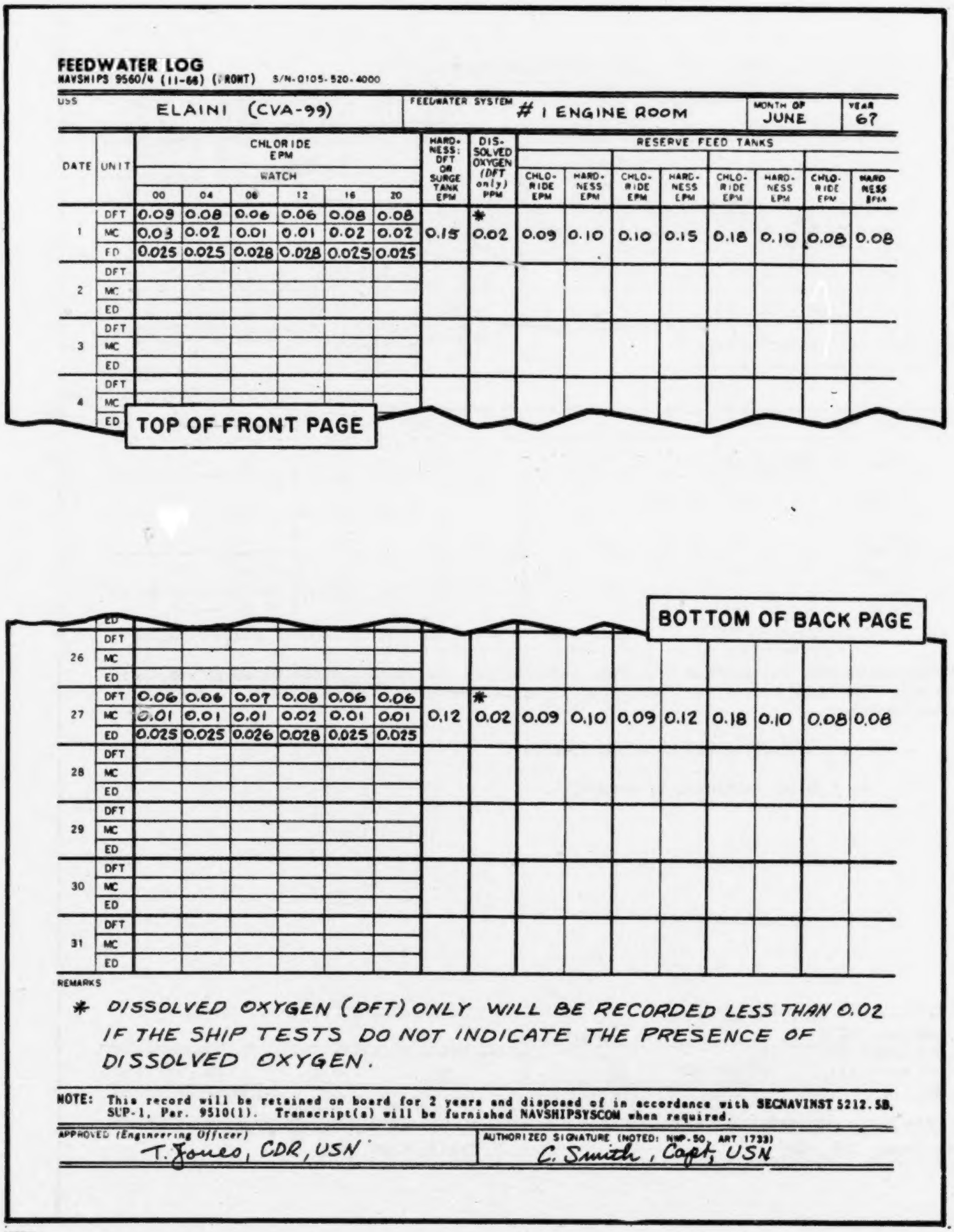
NOTE: This record will be retained on board for 2 years and disposed of in accordance with SECNAVINST 5212.5B, SUP-1, Par. 9510(1). Transcript(s) will be furnished NAVSHIPSYSCOM when required.

APPROVED *(Engineering Officer)*
T. Jones, CDR, USN

AUTHORIZED SIGNATURE (NOTED: NWP-50. ART 1733)
C. Smith, CAPT, USN

98.164.3

Figure 6-16.—Boiler Water Treatment Log—Low Phosphate Treatment.



FEEDWATER LOG
NAVSHIPS 9560/4 (11-66) (FRONT) S/N-0105-520-4000

USS ELAINI (CVA-99)	FEEDWATER SYSTEM # I ENGINE ROOM	MONTH OF JUNE	YEAR 67

DATE	UNIT	CHLORIDE EPM						HARDNESS: DFT OR SURGE TANK EPM	DISSOLVED OXYGEN (DFT only) PPM	RESERVE FEED TANKS							
		WATCH															
		00	04	08	12	16	20			CHLORIDE EPM	HARDNESS EPM	CHLORIDE EPM	HARDNESS EPM	CHLORIDE EPM	HARDNESS EPM	CHLORIDE EPM	HARDNESS EPM
1	DFT	0.09	0.08	0.06	0.06	0.08	0.08		*								
	MC	0.03	0.02	0.01	0.01	0.02	0.02	0.15	0.02	0.09	0.10	0.10	0.15	0.18	0.10	0.08	0.08
	ED	0.025	0.025	0.028	0.028	0.025	0.025										
2	DFT																
	MC																
	ED																
3	DFT																
	MC																
	ED																
4	DFT																
	MC																
	ED																

TOP OF FRONT PAGE

BOTTOM OF BACK PAGE

	ED																
26	DFT																
	MC																
	ED																
27	DFT	0.06	0.06	0.07	0.08	0.06	0.06		*								
	MC	0.01	0.01	0.01	0.02	0.01	0.01	0.12	0.02	0.09	0.10	0.09	0.12	0.18	0.10	0.08	0.08
	ED	0.025	0.025	0.026	0.028	0.025	0.025										
28	DFT																
	MC																
	ED																
29	DFT																
	MC																
	ED																
30	DFT																
	MC																
	ED																
31	DFT																
	MC																
	ED																

REMARKS

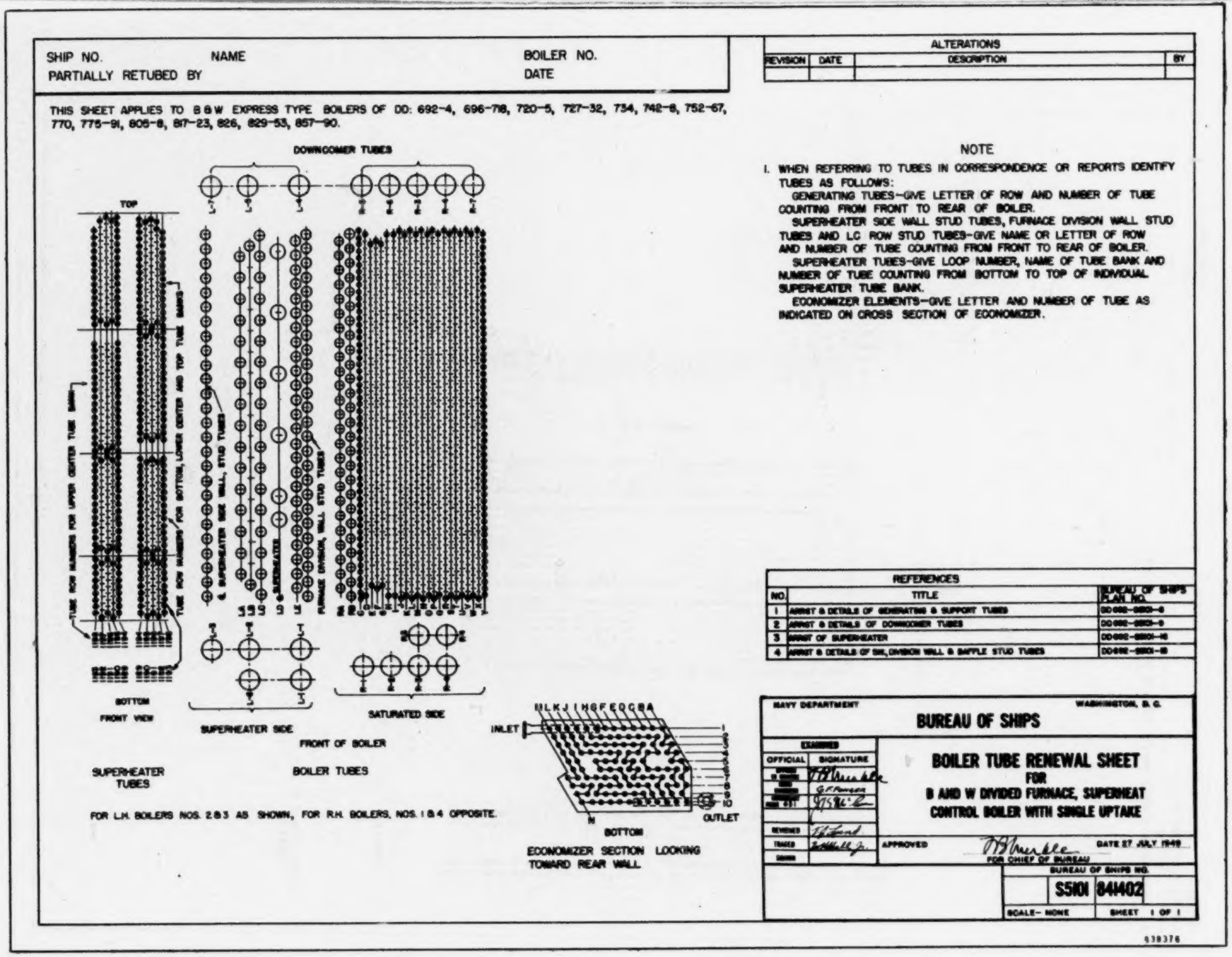
* DISSOLVED OXYGEN (DFT) ONLY WILL BE RECORDED LESS THAN 0.02 IF THE SHIP TESTS DO NOT INDICATE THE PRESENCE OF DISSOLVED OXYGEN.

NOTE: This record will be retained on board for 2 years and disposed of in accordance with SECNAVINST 5212.5B, SUP-1, Par. 9510(1). Transcript(s) will be furnished NAVSHIPSYSCOM when required.

APPROVED (Engineering Officer) T. Jones, CDR, USN	AUTHORIZED SIGNATURE (NOTED: NWP-50, ART 1733) C. Smith, Capt, USN

98.164.4

Figure 6-17.—Feedwater Log.


DOWNCOMER TUBES
TOP
BOTTOM
FRONT VIEW
SUPERHEATER TUBES
TUBE ROW NUMBERS FOR UPPER CENTER TUBE BANK
TUBE ROW NUMBERS FOR BOTTOM, LOWER CENTER AND TOP TUBE BANKS
℄ SUPERHEATER SIDE WALL STUD TUBES
SUPERHEATER
FURNACE DIVISION WALL STUD TUBES
SUPERHEATER SIDE
FRONT OF BOILER
BOILER TUBES
SATURATED SIDE
MLKJIHGFEDCBA
INLET
1
2
3
4
5
6
7
8
9
10
OUTLET
N
BOTTOM
ECONOMIZER SECTION LOOKING TOWARD REAR WALL

SHIP NO. NAME BOILER NO.
PARTIALLY RETUBED BY DATE

ALTERATIONS			
REVISION	DATE	DESCRIPTION	BY

THIS SHEET APPLIES TO B & W EXPRESS TYPE BOILERS OF DD: 692-4, 696-718, 720-5, 727-32, 734, 742-8, 752-67, 770, 775-91, 805-8, 817-23, 826, 829-53, 857-90.

FOR L.H. BOILERS NOS. 2 & 3 AS SHOWN, FOR R.H. BOILERS, NOS. 1 & 4 OPPOSITE.

NOTE

1. WHEN REFERRING TO TUBES IN CORRESPONDENCE OR REPORTS IDENTIFY TUBES AS FOLLOWS:

GENERATING TUBES—GIVE LETTER OF ROW AND NUMBER OF TUBE COUNTING FROM FRONT TO REAR OF BOILER.

SUPERHEATER SIDE WALL STUD TUBES, FURNACE DIVISION WALL STUD TUBES AND LC ROW STUD TUBES—GIVE NAME OR LETTER OF ROW AND NUMBER OF TUBE COUNTING FROM FRONT TO REAR OF BOILER.

SUPERHEATER TUBES—GIVE LOOP NUMBER, NAME OF TUBE BANK AND NUMBER OF TUBE COUNTING FROM BOTTOM TO TOP OF INDIVIDUAL SUPERHEATER TUBE BANK.

ECONOMIZER ELEMENTS—GIVE LETTER AND NUMBER OF TUBE AS INDICATED ON CROSS SECTION OF ECONOMIZER.

REFERENCES		
NO.	TITLE	BUREAU OF SHIPS PLAN NO.
1	ARRGT & DETAILS OF GENERATING & SUPPORT TUBES	DD692-S5101-6
2	ARRGT & DETAILS OF DOWNCOMER TUBES	DD692-S5101-9
3	ARRGT OF SUPERHEATER	DD692-S5101-16
4	ARRGT & DETAILS OF SH, DIVISION WALL & BAFFLE STUD TUBES	DD692-S5101-18

NAVY DEPARTMENT WASHINGTON, D. C.

BUREAU OF SHIPS

EXAMINED
OFFICIAL SIGNATURE
REVIEWED
TRACED
DRAWN

BOILER TUBE RENEWAL SHEET
FOR
B AND W DIVIDED FURNACE, SUPERHEAT
CONTROL BOILER WITH SINGLE UPTAKE

APPROVED
FOR CHIEF OF BUREAU
DATE 27 JULY 1949

BUREAU OF SHIPS NO.
S5101 841402
SCALE—NONE
SHEET 1 OF 1

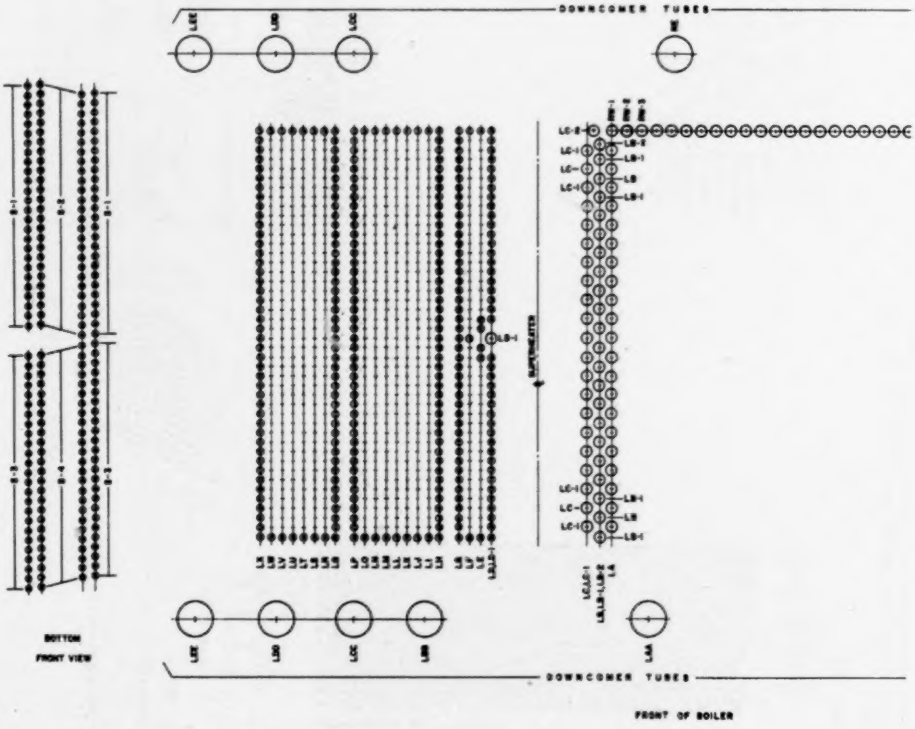
938376

98.168

Figure 6-18.—Boiler Tube Renewal Sheet for a Babcock and Wilcox double-furnace boiler.

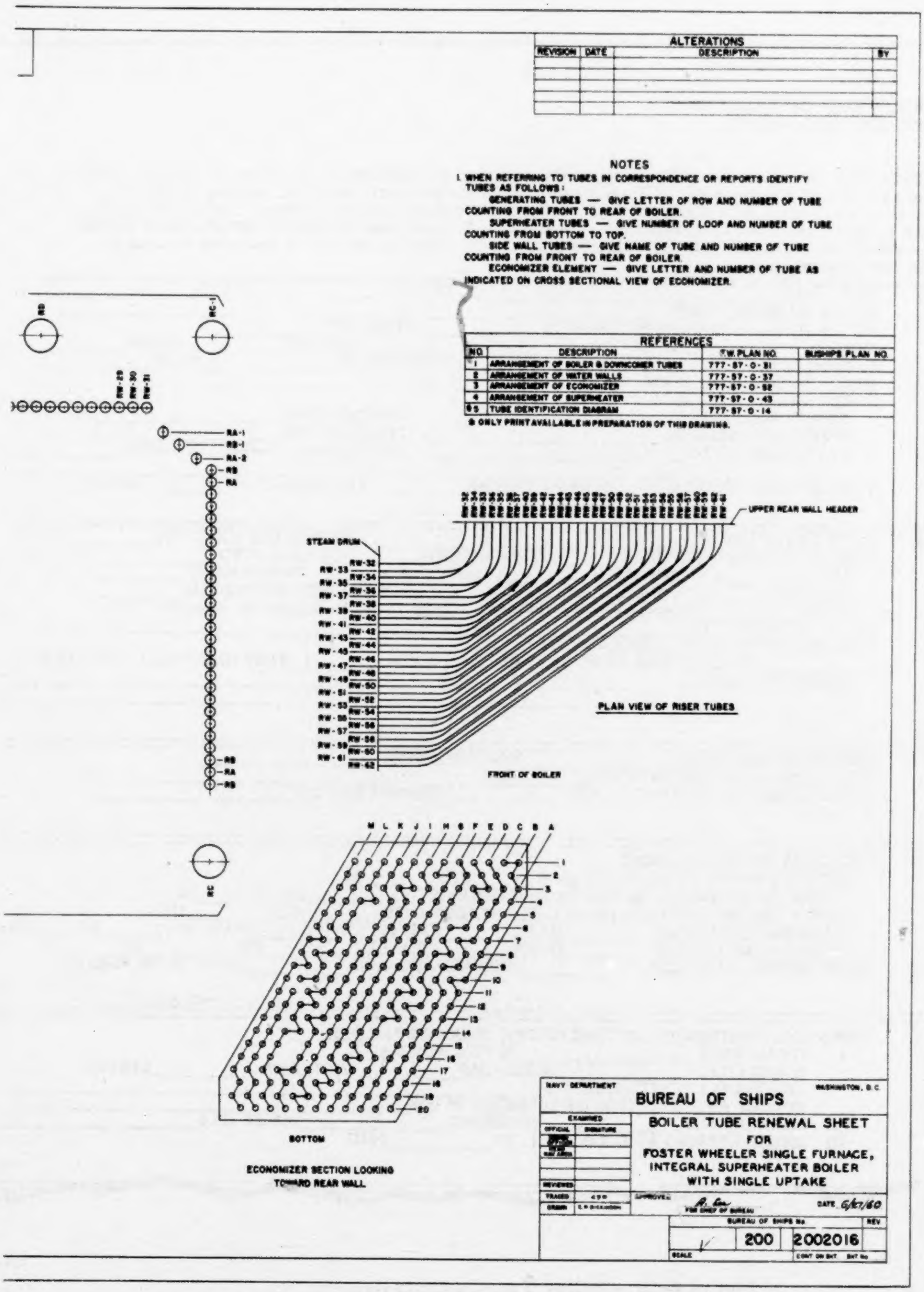
SHIP NO.	NAME	BOILER NO.
PARTIALLY RETUBED BY		DATE

THIS SHEET APPLIES TO FOSTER WHEELER BOILERS OF DDG-4 - DDG-6, DDG-9 & 14


DOWNCOMER TUBES
LC-2
LC-1
LC-
LB-2
LB-1
LB
LB-1
SUPERHEATER
LC,LC-1
LB,LB-1,LB-2
LA
BOTTOM
FRONT VIEW
DOWNCOMER TUBES
FRONT OF BOILER

SUPERHEATER TUBES

BOILER TUBES



ALTERATIONS			
REVISION	DATE	DESCRIPTION	BY

NOTES

1. WHEN REFERRING TO TUBES IN CORRESPONDENCE OR REPORTS IDENTIFY TUBES AS FOLLOWS:

GENERATING TUBES — GIVE LETTER OF ROW AND NUMBER OF TUBE COUNTING FROM FRONT TO REAR OF BOILER.

SUPERHEATER TUBES — GIVE NUMBER OF LOOP AND NUMBER OF TUBE COUNTING FROM BOTTOM TO TOP.

SIDE WALL TUBES — GIVE NAME OF TUBE AND NUMBER OF TUBE COUNTING FROM FRONT TO REAR OF BOILER.

ECONOMIZER ELEMENT — GIVE LETTER AND NUMBER OF TUBE AS INDICATED ON CROSS SECTIONAL VIEW OF ECONOMIZER.

REFERENCES			
NO.	DESCRIPTION	F.W. PLAN NO.	BUSHIPS PLAN NO.
1	ARRANGEMENT OF BOILER & DOWNCOMER TUBES	777-57-0-31	
2	ARRANGEMENT OF WATER WALLS	777-57-0-37	
3	ARRANGEMENT OF ECONOMIZER	777-57-0-52	
4	ARRANGEMENT OF SUPERHEATER	777-57-0-43	
⊕5	TUBE IDENTIFICATION DIAGRAM	777-57-0-14	

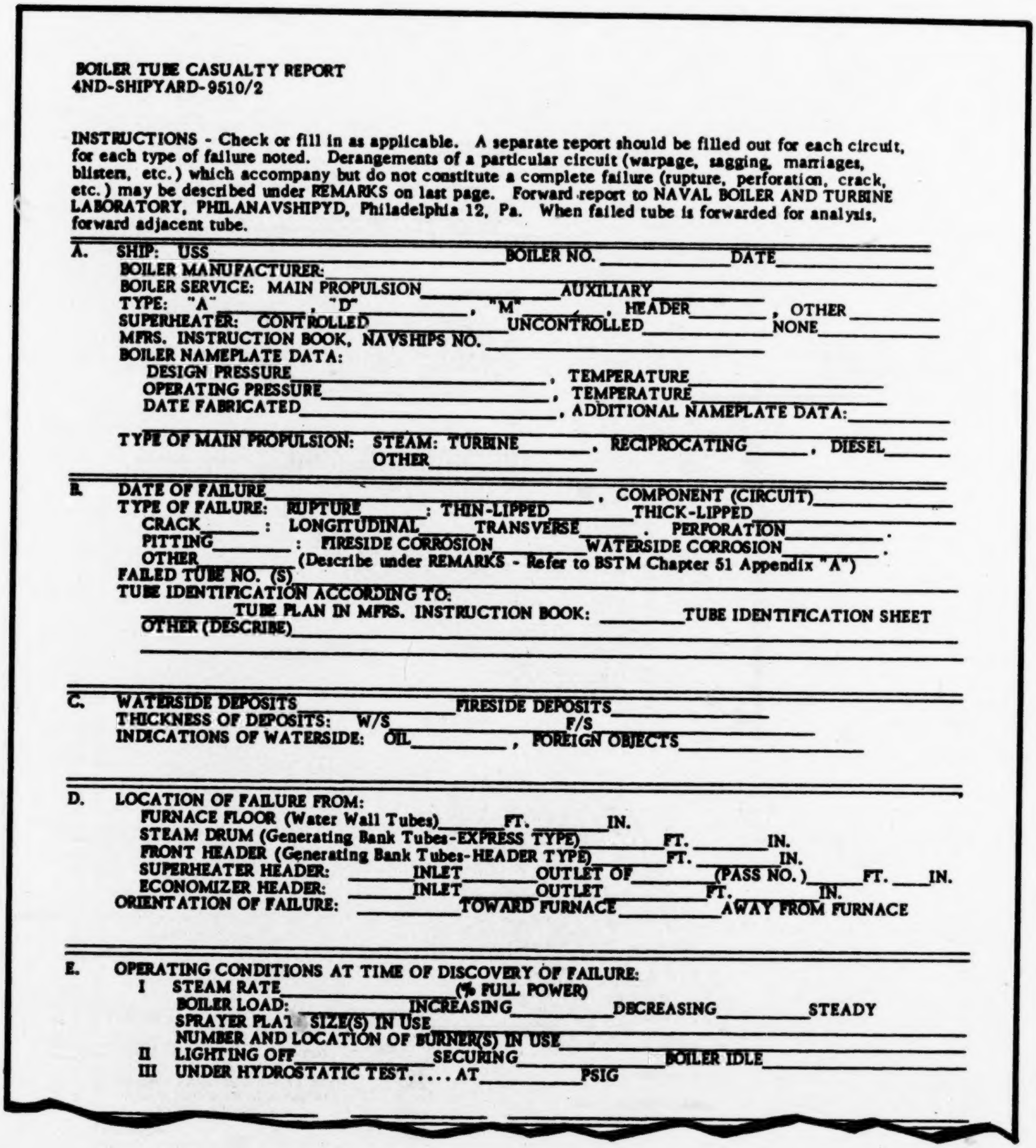
⊕ ONLY PRINT AVAILABLE IN PREPARATION OF THIS DRAWING.

RD
RC-1
RW-29
RW-30
RW-31
RA-1
RB-1
RA-2
RB
RA
RB
RA
RB
UPPER REAR WALL HEADER
STEAM DRUM
RW-32
RW-33
RW-34
RW-35
RW-36
RW-37
RW-38
RW-39
RW-40
RW-41
RW-42
RW-43
RW-44
RW-45
RW-46
RW-47
RW-48
RW-49
RW-50
RW-51
RW-52
RW-53
RW-54
RW-55
RW-56
RW-57
RW-58
RW-59
RW-60
RW-61
RW-62
PLAN VIEW OF RISER TUBES
FRONT OF BOILER
M L K J I H G F E D C B A
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
RC
BOTTOM
ECONOMIZER SECTION LOOKING TOWARD REAR WALL

NAVY DEPARTMENT	WASHINGTON, D.C.
BUREAU OF SHIPS	
EXAMINED	BOILER TUBE RENEWAL SHEET FOR FOSTER WHEELER SINGLE FURNACE, INTEGRAL SUPERHEATER BOILER WITH SINGLE UPTAKE
OFFICIAL / SIGNATURE	
REVIEWED	
TRACED	APPROVED: FOR CHIEF OF BUREAU
DRAWN	DATE 6/27/60
BUREAU OF SHIPS No.	200 / 2002016
SCALE	CONT ON SHT / SHT No / REV

Figure 6-19.—Boiler Tube Renewal Sheet for a Foster Wheeler single-furnace boiler.

98.169.1



BOILER TUBE CASUALTY REPORT
4ND-SHIPYARD-9510/2

INSTRUCTIONS - Check or fill in as applicable. A separate report should be filled out for each circuit, for each type of failure noted. Derangements of a particular circuit (warpage, sagging, marriages, blisters, etc.) which accompany but do not constitute a complete failure (rupture, perforation, crack, etc.) may be described under REMARKS on last page. Forward report to NAVAL BOILER AND TURBINE LABORATORY, PHILANAVSHIPYD, Philadelphia 12, Pa. When failed tube is forwarded for analysis, forward adjacent tube.

A. SHIP: USS ____ BOILER NO. ____ DATE ____
BOILER MANUFACTURER: ____
BOILER SERVICE: MAIN PROPULSION ____ AUXILIARY ____
TYPE: "A" ____, "D" ____, "M" ____, HEADER ____, OTHER ____
SUPERHEATER: CONTROLLED ____ UNCONTROLLED ____ NONE ____
MFRS. INSTRUCTION BOOK, NAVSHIPS NO. ____
BOILER NAMEPLATE DATA:
DESIGN PRESSURE ____, TEMPERATURE ____
OPERATING PRESSURE ____, TEMPERATURE ____
DATE FABRICATED ____, ADDITIONAL NAMEPLATE DATA: ____

TYPE OF MAIN PROPULSION: STEAM: TURBINE ____, RECIPROCATING ____, DIESEL ____
OTHER ____

B. DATE OF FAILURE ____, COMPONENT (CIRCUIT) ____
TYPE OF FAILURE: RUPTURE ____: THIN-LIPPED ____ THICK-LIPPED ____
CRACK ____: LONGITUDINAL ____ TRANSVERSE ____. PERFORATION ____.
PITTING ____: FIRESIDE CORROSION ____ WATERSIDE CORROSION ____.
OTHER ____ (Describe under REMARKS - Refer to BSTM Chapter 51 Appendix "A")
FAILED TUBE NO. (S) ____
TUBE IDENTIFICATION ACCORDING TO:
____ TUBE PLAN IN MFRS. INSTRUCTION BOOK: ____ TUBE IDENTIFICATION SHEET
OTHER (DESCRIBE) ____

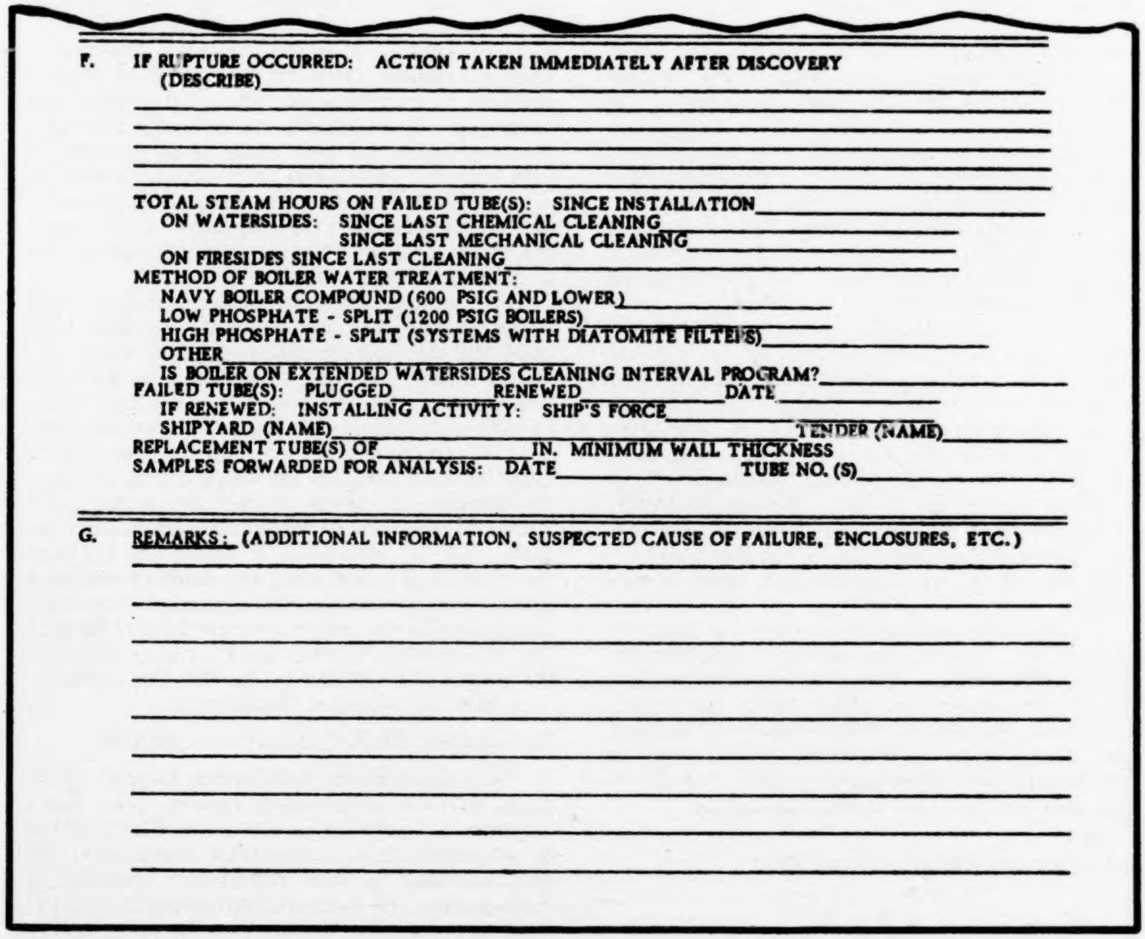
C. WATERSIDE DEPOSITS ____ FIRESIDE DEPOSITS ____
THICKNESS OF DEPOSITS: W/S ____ F/S ____
INDICATIONS OF WATERSIDE: OIL ____, FOREIGN OBJECTS ____

D. LOCATION OF FAILURE FROM:
FURNACE FLOOR (Water Wall Tubes) ____ FT. ____ IN.
STEAM DRUM (Generating Bank Tubes-EXPRESS TYPE) ____ FT. ____ IN.
FRONT HEADER (Generating Bank Tubes-HEADER TYPE) ____ FT. ____ IN.
SUPERHEATER HEADER: ____ INLET ____ OUTLET OF ____ (PASS NO.) ____ FT. ____ IN.
ECONOMIZER HEADER: ____ INLET ____ OUTLET ____ FT. ____ IN.
ORIENTATION OF FAILURE: ____ TOWARD FURNACE ____ AWAY FROM FURNACE

E. OPERATING CONDITIONS AT TIME OF DISCOVERY OF FAILURE:
I STEAM RATE ____ (% FULL POWER)
BOILER LOAD: ____ INCREASING ____ DECREASING ____ STEADY
SPRAYER PLATE SIZE(S) IN USE ____
NUMBER AND LOCATION OF BURNER(S) IN USE ____
II LIGHTING OFF ____ SECURING ____ BOILER IDLE ____
III UNDER HYDROSTATIC TEST..... AT ____ PSIG

98.170

Figure 6-20.—Boiler Tube Casualty Report.



F. IF RUPTURE OCCURRED: ACTION TAKEN IMMEDIATELY AFTER DISCOVERY
(DESCRIBE)____________________

TOTAL STEAM HOURS ON FAILED TUBE(S): SINCE INSTALLATION____________________
ON WATERSIDES: SINCE LAST CHEMICAL CLEANING____________________
SINCE LAST MECHANICAL CLEANING____________________
ON FIRESIDES SINCE LAST CLEANING____________________
METHOD OF BOILER WATER TREATMENT:
NAVY BOILER COMPOUND (600 PSIG AND LOWER)____________________
LOW PHOSPHATE - SPLIT (1200 PSIG BOILERS)____________________
HIGH PHOSPHATE - SPLIT (SYSTEMS WITH DIATOMITE FILTERS)____________________
OTHER____________________
IS BOILER ON EXTENDED WATERSIDES CLEANING INTERVAL PROGRAM?____________________
FAILED TUBE(S): PLUGGED__________ RENEWED__________ DATE__________
IF RENEWED: INSTALLING ACTIVITY: SHIP'S FORCE__________
SHIPYARD (NAME)____________________ TENDER (NAME)__________
REPLACEMENT TUBE(S) OF__________ IN. MINIMUM WALL THICKNESS
SAMPLES FORWARDED FOR ANALYSIS: DATE__________ TUBE NO. (S)__________

G. REMARKS: (ADDITIONAL INFORMATION, SUSPECTED CAUSE OF FAILURE, ENCLOSURES, ETC.)

98.170

Figure 6-20.—Boiler Tube Casualty Report—Continued.

4. The best way to submit a sample of a tube deposit is usually to submit a section of the tube with the deposit still in place. If for some reason this cannot be done, the deposit sample should be separated from the metal with a sharp instrument that is capable of taking the entire thickness of the deposit, down to the sound metal. As a last resort, deposit samples may be obtained by scraping or brushing; however, samples taken in this way are so broken up and frequently so contaminated with other material that it is generally very difficult to obtain useful information from them.

5. Deposit samples should be forwarded in clean bottles or cans. The container should be permanently marked with all the required identifying information.

6. A 1-gallon sample of boiler water, taken while the boiler is being emptied or just before it is emptied, should be submitted with samples of waterside deposits. The bottle in which the boiler water sample is submitted should be entirely clean before the sample is collected. The bottle should be filled almost (but not quite) to the top; it must be tightly stoppered; and it must be clearly labeled with all identifying information, including information on recent water tests and water treatment.

7. When samples are submitted for analysis, they should be accompanied by an explanatory letter. The letter should include information on the circumstances under which the failure occurred, the cause of the failure (if known), the firing rate at the time, the number of steaming hours since the last waterside cleaning, and any other pertinent information.

ELECTRONIC FAILURE REPORT

The Electronic Failure Report, form DD787, is a report rendered on the failure of certain electronic equipment listed in the current revision of NavShips Instruction 10550.73. A separate form is submitted to the Naval Ship Systems Command for each electron tube or electronic part failure. The report form should be completed and submitted as soon as possible after the repair is accomplished. For electronic equipments under the cognizance of the engineer officer, the report is mailed promptly to NavShips without a covering letter unless it is necessary to supplement the remarks portion of the report form.

SHIP CHARACTERISTICS CARDS

The Ship Characteristics Card, OpNav 9010-2, is a report of comprehensive information essential to an understanding of the characteristics and capabilities of surface ships and service craft. A similar report, Submarine Characteristics Card (OpNav 9010-1) is applicable to submarines. The distribution and frequency of submission of the ship and submarine characteristics cards is in accordance with current OpNav and appropriate fleet commander's directives. The current revision of OpNav Instruction 9010.8 applies. Instructions for completing the forms are published on one of the pages comprising the report.

The data in the Ship Characteristics Card must be accurate and complete because it is used for planning purposes by CNO. Where accurate data are not available, an estimate (marked E) will be given but exact data must be obtained and submitted as soon as practicable.

CNO requires that the Ship Characteristics card be submitted by all ships (1) upon commissioning or being placed in service, (2) within 30 days after completion of regular overhaul, and (3) whenever a change in military characteristics (including any change in weapons installations) is made. The engineer officer must make certain that the current revision of the Ship Characteristics Card is used for submission of the report. When filled in, the Ship Characteristics Card is classified Confidential.

ELECTRONICS INSTALLATION RECORD

The Electronics Installation Record (NavShips 4110) is an inventory record of the ship's electronics installation. This record is prepared by all active ships or cognizant commands. The data included in this report are required by management and command personnel for operations and planning. Instructions for the preparation, revision, and submission of the record are published in Reporting Electronic Equipment Installations, NavShips 900135 (revised). The copy of any publication referred to for instructions when preparing a report must be the latest revised copy of the publication because reporting procedures are frequently changed. A report that is submitted incorrectly or that contains incomplete information can cause considerable confusion and inconvenience by requiring additional correspondence which unduly burdens the person making the report as well as the recipient.

132

FORM	SUBJECT	DESTINATION	REFERENCE
NavPers 3041	Motion Picture Damage, Loss and Destruction Report.	BuPers	Art. C-9403, BuPers Manual
NavShips 223-1, 223-4, 223-4a, 223-6, & 223-8	Docking Report.	NavShips	NavShips Technical Manual
Letter, drawing or sketch	Report of Solid Ballast Installation or Change.		NavShips Technical Manual
Letter	Report of Pounding or Inadequate Propeller Immersion.	NavShips	NavShips Technical Manual
Letter	Bent or Cracked Shafts.	NavShips	NavShips Technical Manual
NavShips 4212-1, 4214-1, 4214-2, 4213-1 (according to design)	Report of Turbine Lifting and Repair.	NavShips	NavShips Technical Manual
Letter	Request for change of Authorized Settings on Boiler Safety Valves.	NavShips	NavShips Technical Manual
NavShips 1104	Magnetic Compass Table.	NavShips	NavShips Technical Manual
Letter	Report of Storm Damage to Ships.	NavShips	NavShips Technical Manual
Letter	Defective Condition of Heating Coils in Fuel Oil Tanks	NavShips	NavShips Technical Manual

114.25

Figure 6-21. —Summary of Situation Reports.

The ship's electronic equipment is divided into eight major categories for the purpose of reporting the ship's electronics installation. Category 7 is the ship's interior communications equipment and includes the following:

1. Shipboard announcing system amplifiers and loudspeakers.
2. Sound recorders.
3. Record players.
4. Portable announcing and public address systems.
5. Ship's entertainment systems.
6. Intercommunications units.
7. Communication console equipment.
8. Sound-powered telephone amplifiers.

MAIN PROPULSION TURBINE CONDITION REPORT

The Main Propulsion Turbine Condition Report is a letter report of the condition of each propulsion turbine and is submitted to the Naval Ship Systems Command via the type commander 3 months prior to each regular overhaul. A copy of the report is forwarded to the shipyard to which the ship is assigned for overhaul. The report includes data and information on the turbines in accordance with the requirements of the chapter in NavShips Technical Manual pertaining to main propelling machinery. Included in the report are recommendations by the commanding officer and type commander that the turbine should or should not be disassembled for inspection and overhaul during the regular overhaul period.

When the type commander's endorsement on the turbine condition report recommends disassembly of the turbine casing, the Naval Ship Systems Command reviews and normally approves the recommendation; however, additional information may be requested for justification, or alternate or additional tests and inspections prior to disassembly of the casing may be recommended. When the turbine report indicates the condition of the turbine is satisfactory and no urgent alterations are known to be necessary, the Naval Ship Systems Command does not answer the report. Any answer from NavShips involving a recommendation to disassemble the turbine casing or to perform additional tests or inspections will be directed to the type commander with copies to the reporting ship, the overhaul activity, and any other activities concerned. Final authority for disassembling the casing is the reponsibility of the activity (usually the type commander) controlling the operating schedule and overhaul funds of the ship.

SITUATION REPORTS

Situation reports are one-time reports required when certain situations arise. Figure 6-21 is a summary of one-time reports (not previously described) pertaining to the engineering department. The situations that occasion the reports listed in the summary are explained in the references given.

CHAPTER 7

ENGINEERING MATERIAL

One of the problem areas for the engineering department is SUPPLY. The Navy supply system is charged with the responsibility of procurement, storage, delivery, and accounting for all materials used in the Navy. This responsibility also applies at the shipboard level, but, while one department may have the responsibility for a specific function aboard ship, it usually requires the cooperation and assistance of other departments to discharge that responsibility.

The purpose of this chapter is to provide an insight into and a common ground of understanding of supply procedures.

As a result of the reorganization of the Navy, the Bureau of Supplies and Accounts became the Naval Supply Systems Command, the abbreviation changed from BuSandA to NavSup, and, as a result, the prefix for supply forms was changed from NavSandA to NavSup. These forms are officially NavSup forms and are listed as such in NavSup Manual, volume 1, chapter 5 and in the catalog of forms and publications. In referring to supply forms, the terms NavSandA and NavSup are synonymous. As the forms are revised, the NavSandA prefix to the form number will be changed to NavSup, but the form numbers will remain the same.

In this chapter, the forms will be referred to as NavSup forms regardless of the prefix appearing on the forms in the illustrations and in actual use.

TYPES OF MATERIAL

To satisfy the requirements of material reporting and accounting the Navy divides material into five categories: (1) equipment, (2) equipage, (3) repair parts, (4) consumable supplies, and (5) services.

Equipment is considered to be any functional electronic, ordnance, hull, mechanical, or electrical unit which is operated singly or as a component of a system or subsystem and which is identified by a Component Identification Number/Allowance Parts List (CID/APL). Examples of equipment are turbines, pumps, and electric motors.

Equipage is an item of a durable nature which is not altered or consumed in use. The allowance of equipage can be and usually is determined on an individual ship basis and is contained in Allowance Parts Lists (APL), Allowance Equipage Lists (AEL), or other authorization issued by commands, bureaus, or offices. Equipage items differ from equipment in that they are usually portable and pilferable.

Certain items of equipage are designated "controlled equipage" and require increased management control due to any one or a combination of the following:

1. High unit cost
2. Vulnerability to pilferage
3. Essentiality to the ship's mission.

A listing of items designated as controlled equipage is contained in Appendix II of NavSup Manual volumes III and VIII. Those items requiring custodial signatures are denoted by asterisks.

A repair part is any item which appears in an Allowance Parts List (APL), a manufacturer's instruction book, or a similar parts list. Consumable materials, such as gaskets, which have an equipment application are also considered repair parts.

Consumable supplies are administrative and housekeeping items, general purpose hardware, common tools, or any other item not specifically defined as equipage or repair parts.

Services are nonmaterial requirements such as equipment rental, commercial telephone, pilotage, and tug hire.

135

IDENTIFICATION OF MATERIALS

Rarely do any two persons observe exactly the same details of the same object, much less describe them in the same words. It was this need for a brief, accurate means of identifying one specific item of material that led to the Federal Catalog System presently in use throughout the Department of Defense and civil agencies of the Government. This system requires that only one identification number be assigned to a specific item of material used by and carried under centralized inventory control of any civil or military agency of the Federal Government. The Federal Catalog System includes naming, describing, classifying, and numbering all items and the publication of catalogs and stock and identification lists.

FEDERAL STOCK NUMBERS

The Federal Stock Number (FSN) is the common language of material identification. The first four digits of the FSN compose the Federal Supply Classification (FSC), which has two elements: group and class.

The FSC consists of 90 groups (some unassigned), which are subdivided into approximately 550 classes. Each class covers a particular area of commodities, in accordance with their physical or performance characteristics, or based on the fact that the items in the class are usually requisitioned or issued together. Below is an example of how the classes are used to divide types of material within a stock group.

Group	Class	Material
53		Hardware and abrasives
	05	Screws
	06	Bolts
	07	Studs
	10	Nuts and washers
	15	Nails, keys, and pins
	20	Rivets
	25	Fastening devices
	30	Packing and gasket materials
	35	Metal screening
	40	Miscellaneous hardware
	45	Disks and stones, abrasive
	50	Abrasive materials
	55	Knobs and pointers

Together, the stock group and class are known as the FSC and form the first four digits of the FSN.

The second element of the FSN is the Federal item identification number (FIIN). The FIIN is assigned to a specific item of material and bears no relationship to any other FIIN. The FSC is used to group and classify similar types of material, but two similar items listed side by side in the catalog may have FIINs such as 541-4078 and 268-3579.

COGNIZANCE SYMBOLS

A two part cognizance symbol is used within the Navy to provide supply management information. There are numerous cognizance symbols currently in use although the majority of stock transactions aboard ship are covered by 1H, 1N, 9C, 9N, 9Q, and 9Z. The first part is a single number that denotes the stores account (discussed later in the chapter) in which the material is carried in the supply system. Briefly the numeral part of the cognizance symbol indicates the following:

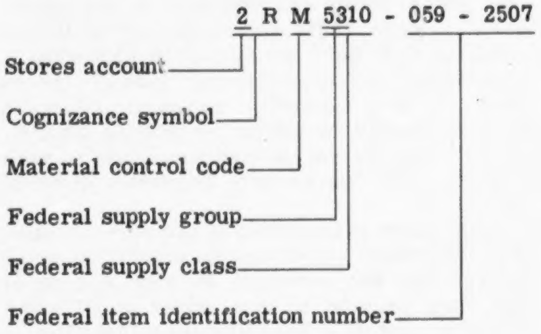
1, 3, 5, 7	Material held in the Naval Stock Account (NSA). When this material is issued, it must be paid for by the requisitioner.
9	Material originally purchased by the Defense Stock Fund but now held in NSA. When this material is issued, it must be paid for by the requisitioner.
2, 4, 6, 8	Material held in the Appropriations Purchases Account. This material is currently issued without charge to the requisitioner.
0	Material not carried in a stores account.

The second part of the cognizance symbol is a single letter code that designates the inventory manager of Inventory Control Point (ICP) that has cognizance, or control, of the material. These inventory managers may be Navy or Defense activities.

MATERIAL CONTROL CODE

The material control code (MCC) is a one letter code assigned by the inventory manager to indicate the rate of usage or to designate those items having special reporting and/or control requirements. The MCC is placed after the cognizance symbol in the FSN.

The following FSN illustrates all of the elements that have been discussed:



IDENTIFICATION PUBLICATIONS

The primary publications which the engineering department will use aboard ship in identifying material are the Coordinated Shipboard Allowance List (COSAL), manufacturers' publications such as technical manuals and catalogs, and technical bureau or systems command publications.

Most identification publications have notes or introductions which explain fully how to use them. These publications can be rather complex, and if anyone in the department has trouble in deciphering the various codes or reference numbers, supply department personnel will be glad to help, for the clearer the understanding of identification publications, the easier the job will be.

Allowance Lists

Allowance lists are planned to include all nonconsumable items and supporting materials essential to the efficient operation and maintenance of a ship and to limit the quantity and type of such items as equipment, controlled equipage, and repair parts that may be carried aboard at any one time. Ships normally are required to carry a full allowance but are not permitted to exceed the allowance except: when demand information for repair parts warrants an increase; with the approval of the type commander; or, for specified categories of material, with approval of the type commander and cognizant systems command or bureau.

The supply department uses allowance lists in determining responsibility for materials and in maintaining custody records and accountability for items of controlled equipage. Allowance lists are also used as authority for procurement and replacement of allowed equipment.

Allowance lists for consumable supplies are merely guides to the range and quantities of material that probably will be required to operate a given type of ship. A ship may exceed quantities shown in these lists for individual items without submitting a request for change in allowance.

Allowance lists not only limit procurement of nonconsumables and serve as guides in the procurement of consumables, they also provide valuable identification data not immediately available from other sources. Allowance lists are the first source that should be consulted for stock numbers of items known to be in the ship's allowance.

COSAL

The Coordinated Shipboard Allowance List (COSAL) is a technical and supply management document that is designed to enable ships to achieve maximum operating capability for extended periods of time, independent of external logistic support.

The COSAL is technical in that it provides nomenclature, operating characteristics, specifications, parts lists, and other technical data pertaining to all installed equipment and machinery, and nomenclature and characteristics of the equipage and tools required to operate and maintain the ship and its equipment.

The COSAL is a supply management document in that it tells the supply officer how much of what material to stock in his storerooms and the allowance of equipage items that must be carried aboard ship.

The allowances of material to be carried in the storerooms and material required in the operating spaces are prepared by computers from the hundreds of APL/AELs that apply to an individual ship. The preparation of these allowance lists takes into account all of the installed equipment on board, the quantity of each item of that equipment, the failure rate of parts, and the relative importance of these parts to the operation of the equipment.

Of course, the COSAL will not provide parts for every equipment breakdown. To do this, a complete set of spare equipment and machinery would have to be carried on board, which is impossible. The COSAL can be expected to improve, however, as more accurate usage data are collected through the 3M system utilized by the COSAL preparation activities. The engineering department will be concerned primarily with the Hull, Mechanical, Electrical and Ordnance COSAL prepared by Ships' Parts Control Center (SPCC). The Electronic COSAL prepared by the Electronic Supply Office will also be used since it contains support for IC equipment.

The COSAL does not include ship's store stocks, resale clothing, bulk fuels, subsistence items, expendable ordnance or repair parts for aircraft. These items are covered by separate outfitting and load lists. Allowance requirements for nuclear weapons, guided missiles, and certain FBM equipment are included in special supplements to the COSAL.

Both SPCC and ESO publish an Introduction section which gives detailed descriptions of the parts and contents of the COSALs and information that will be helpful when using them. Because of the limited use of the ESO COSAL in the engineering department, only the SPCC COSAL is discussed in this chapter.

The SPCC COSAL is divided into parts and sections as follows:

Part I

- Summary of Effective Allowance Parts/Equipage Lists
- Index—Section A
- Index—Section B

Part II

- Section A—Allowance Parts Lists (APL)
- Section B—Allowance Equipage Lists (AEL)

Part III

- Section A—Stock Number Sequence List - Storeroom items (SNSL-SRI)
- Section B—Stock Number Sequence List - Operating Space Items (SNSL-OSI)
- Section C—Not used at this time.
- Section D—Alternate Number Cross-Reference to Stock Number
- Section E—Generally used, consumable, nonequipment related items. For initial outfitting of a ship's operating spaces and storerooms.

The Summary of Effective Allowance Parts/Equipage Lists is a numerical list of all APLs and AELs which are included in the ship's SPCC COSAL. This summary may be used to check part II for missing APL/AELs when a new COSAL is received and periodically thereafter. It is in numerical sequence and should be kept current by adding or deleting identification numbers as changes are made to your COSAL. The Summary is illustrated in figure 7-1.

The Index is published in two parts, Section A and Section B. Both contain exactly the same information but arranged in such a manner that they provide a cross-index of all APL/AELs in part II. The following information is number keyed to the columns of the A and B indexes shown in figure 7-2.

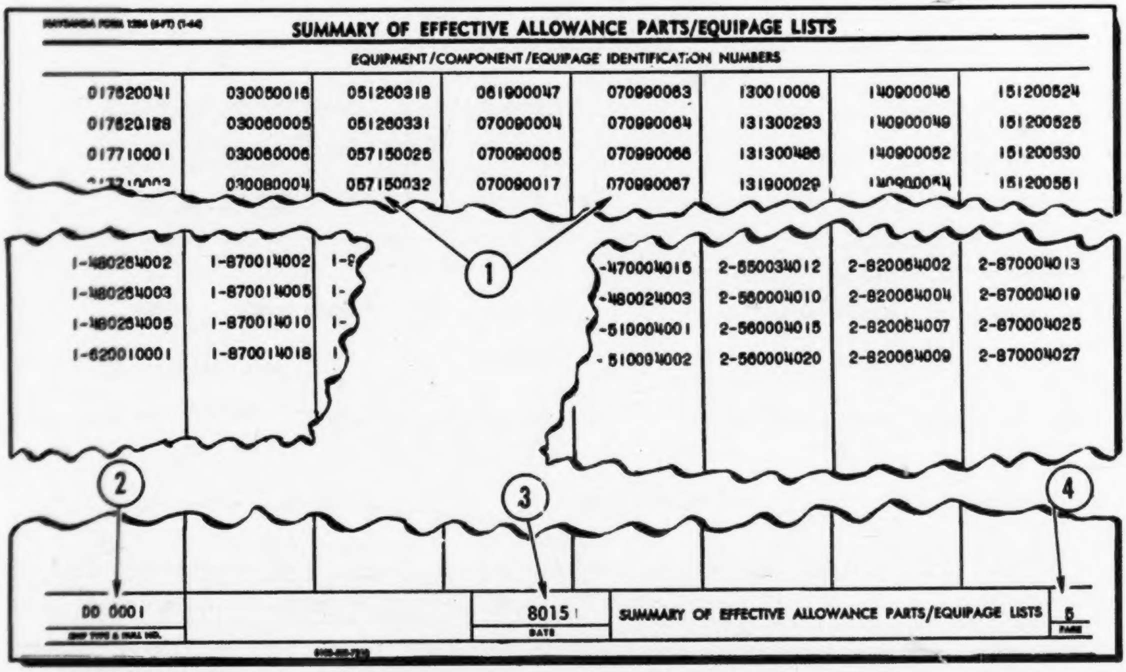
Allowance Parts List (APL).—The APL is a technical document prepared for a specific item or component of equipment and lists descriptive data and characteristics of the equipment, repair parts, and other technical and supply management information. The COSAL binder should contain an APL for every item or component of equipment on board.

Each APL is assigned a nine-digit identifying number by SPCC. The first two digits identify the equipment/component category and are listed in an index in the COSAL Introduction. The APLs are filed in numerical sequence in Part II of the COSAL.

An APL number containing a letter "P" prefix may be encountered. This indicates an incomplete APL. The body of the APL usually tells why it is incomplete and the action being taken or required to complete it.

An APL will not always cover a complete equipment; refer to the Section B Index, figure 7-2. The first entry is "ELEC POWER SUPPLY - EMER SSERV DELEC ENGINE." This is the name of a complete system or equipment, the diesel electric engine for the emergency ship's service electric power supply. Column 2 lists the various components of the diesel electric engine, each of which, in this case, has its own APL number. Thus, the APL may cover a complete equipment or only one component of that equipment. An example of an APL page is shown in figure 7-3. The

138



SUMMARY OF EFFECTIVE ALLOWANCE PARTS/EQUIPAGE LISTS

EQUIPMENT/COMPONENT/EQUIPAGE IDENTIFICATION NUMBERS

017620041	030050016	051260318	061900047	070990063	130010008	140900046	151200524
017620188	030060005	051260331	070090004	070990064	131300293	140900049	151200525
017710001	030060006	057150025	070090005	070990066	131300486	140900052	151200530
[illegible]	030080004	057150032	070090017	070990067	131900029	140900054	151200551

1-480264002	1-870014002	1-8		-470004016	2-550034012	2-820064002	2-870004013
1-480264003	1-870014005	1-		-480024003	2-560004010	2-820064004	2-870004019
1-480264005	1-870014010	1-		-510004001	2-560004015	2-820064007	2-870004025
1-620010001	1-870014018	1		-510004002	2-560004020	2-820064009	2-870004027

DD 0001		8015	SUMMARY OF EFFECTIVE ALLOWANCE PARTS/EQUIPAGE LISTS	5
SHIP TYPE & HULL NO.		DATE		PAGE

1. Equipment/Component/Equipage Identification Numbers - The APL and AEL Identification Numbers in numerical sequence starting at the top of the page and continuing to the bottom and from left to right.
2. Ship Type and Hull No. - The specific ship for which the Summary is published.
3. Date - May be shown as a Julian date (8015 - 15 January 1968) or as month-day-year (01-15-68).
4. Page - Consecutive page number of the Summary.

123.1

Figure 7-1.—Summary of effective allowance parts/equipage lists.

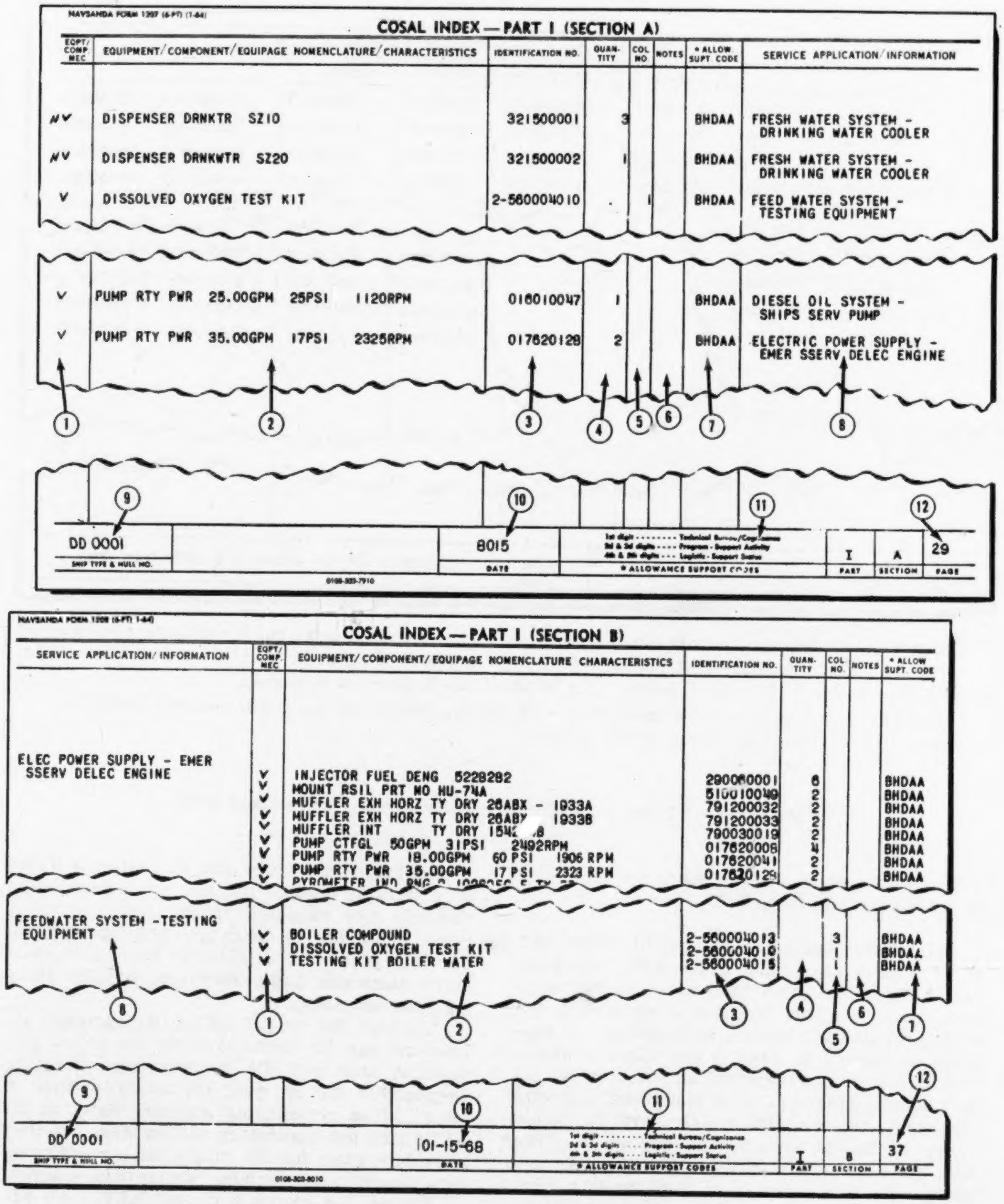
different data elements are numbered and refer to the numbers in table 7-2.

Allowance Equipage List (AEL).—The AEL is similar in appearance to the APL, but where the APL is designed to provide maintenance and repair support for ship's equipment, the AEL provides allowances of equipage and supplies necessary to support the ship's mission. The APL provides technical information for the man maintaining a piece of equipment and tells the supply officer what repair parts he should carry in the storeroom to support it. The AEL tells the commanding officer, supply officer, and other heads of departments what equipage and supplies are required to enable the ship to operate efficiently and effectively.

Equipage is a term used to designate items of a durable nature that are not consumed in use and are essential to the ship's mission. Some examples of equipage are typewriters, portable power tools (electric drills and pneumatic hammers, life preservers, special clothing, and test sets).

Through the use of AELs, an equipage allowance can be tailored to fit the needs of a specific ship and the commanding officer is responsible for carrying the full allowance on board. The consumable supplies listed on the AELs are not mandatory allowances, but they provide a guide for the supply officer and using department in determining what is to be ordered.

Figure 7-4 shows a typical AEL. An explanation of the data blocks and columns is



NAVSANDA FORM 1207 (6-PT) (1-64)

COSAL INDEX — PART I (SECTION A)

EQPT/ COMP MEC	EQUIPMENT/COMPONENT/EQUIPAGE NOMENCLATURE/CHARACTERISTICS	IDENTIFICATION NO.	QUAN-TITY	COL NO.	NOTES	* ALLOW SUPT CODE	SERVICE APPLICATION/INFORMATION
NV	DISPENSER DRNKTR SZ10	321500001	3			BHDAA	FRESH WATER SYSTEM - DRINKING WATER COOLER
NV	DISPENSER DRNKWTR SZ20	321500002	1			BHDAA	FRESH WATER SYSTEM - DRINKING WATER COOLER
V	DISSOLVED OXYGEN TEST KIT	2-560004010	.	1		BHDAA	FEED WATER SYSTEM - TESTING EQUIPMENT
V	PUMP RTY PWR 25.00GPM 25PSI 1120RPM	016010047	1			BHDAA	DIESEL OIL SYSTEM - SHIPS SERV PUMP
V	PUMP RTY PWR 35.00GPM 17PSI 2325RPM	017620129	2			BHDAA	ELECTRIC POWER SUPPLY - EMER SSERV DELEC ENGINE

DD 0001		8015	1st digit ------- Technical Bureau/Cognizance 2d & 3d digits ---- Program - Support Activity 4th & 5th digits --- Logistic - Support Status	I	A	29
SHIP TYPE & HULL NO.		DATE	* ALLOWANCE SUPPORT CODES	PART	SECTION	PAGE

NAVSANDA FORM 1208 (6-PT) 1-64)

COSAL INDEX — PART I (SECTION B)

SERVICE APPLICATION/ INFORMATION	EQPT/ COMP. MEC	EQUIPMENT/ COMPONENT/ EQUIPAGE NOMENCLATURE CHARACTERISTICS	IDENTIFICATION NO.	QUAN-TITY	COL. NO.	NOTES	* ALLOW SUPT. CODE
ELEC POWER SUPPLY - EMER SSERV DELEC ENGINE	V	INJECTOR FUEL DENG 5228282	290060001	6			BHDAA
	V	MOUNT RSIL PRT NO HU-74A	510010049	2			BHDAA
	V	MUFFLER EXH HORZ TY DRY 26ABX - 1933A	791200032	2			BHDAA
	V	MUFFLER EXH HORZ TY DRY 26ABY 1933B	791200033	2			BHDAA
	V	MUFFLER INT TY DRY 154[illegible]8	790030019	2			BHDAA
	V	PUMP CTFGL 50GPM 31PSI 2492RPM	017620008	4			BHDAA
	V	PUMP RTY PWR 18.00GPM 60 PSI 1906 RPM	017620041	2			BHDAA
	V	PUMP RTY PWR 35.00GPM 17 PSI 2323 RPM	017620129	2			BHDAA
	V	PYROMETER IND RNG					
FEEDWATER SYSTEM -TESTING EQUIPMENT	V	BOILER COMPOUND	2-560004013		3		BHDAA
	V	DISSOLVED OXYGEN TEST KIT	2-560004019		1		BHDAA
	V	TESTING KIT BOILER WATER	2-560004015		1		BHDAA

DD 0001		101-15-68	1st digit ------- Technical Bureau/Cognizance 2d & 3d digits ---- Program - Support Activity 4th & 5th digits --- Logistic - Support Status	I	B	37
SHIP TYPE & HULL NO.		DATE	* ALLOWANCE SUPPORT CODES	PART	SECTION	PAGE

17.61:.62

Figure 7-2.—COSAL index.

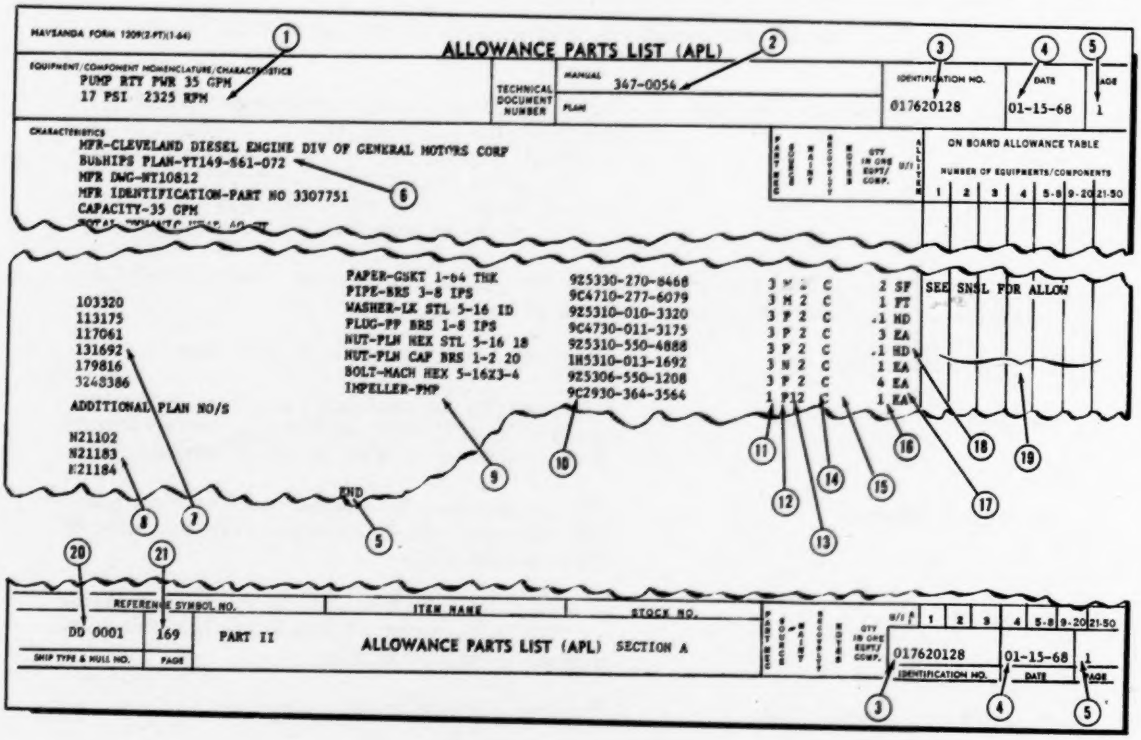
Table 7-1. Description of contents of columns of COSAL Index, Fig. 7-2.

1. Equipment/Component Military	Indicates those items of equipment that are essential to the ship's mission. V—Vital. Failure of the equipment could reduce the ship's capability to perform its mission. NV—Nonvital. Failure of the equipment would not adversely affect the ship's mission.
2. Equipment/Component/Equipage Nomenclature/Characteristics	The noun name and partial characteristic description of each APL and AEL.
3. Identification Number	The APL or AEL identification number.
4. Quantity	The quantity of each equipment/component per service aboard ship, covered by the applicable APL. Column 4 will be blank for all AELs.
5. Column Number	The applicable AEL column number from which the allowance is determined. This column is blank for all APLs.
6. Notes	A code that indicates specific information about an APL/AEL entry. These codes are listed and defined in the Introduction.
7. Allowance Support Code	Reserved for future use. (See item 11.)
8. Service Application/Information	The service or major shipboard function in which the equipment/component/equipage operates or performs a service.
9. Ship Type and Hull Number	The specific ship for which the COSAL is prepared.
10. Date	Date of preparation (may be expressed as Julian or month-day-year date).
11. Allowance Support Codes	Pertains to item 7.
12. Page	Consecutive page numbering from first page to last. Page numbers preceded by "H" apply to Hull, Mechanical and Electrical (Example H-1). Page numbers preceded by "Z" apply to Ordnance (Example Z-1).

given in table 7-3 and is number keyed to the AEL.

The Characteristics (No. 6) may contain, in addition to the description of the equipage, information to assist you in determining allowance quantity, equipage type, and substitutions necessary because of differences in the installed equipment and characteristics of the ship.

The Quantity column (No. 18) is normally blank, but, when it is used as in figure 7-4, it shows the quantity of the individual items included in the equipage item. This indicates what items are included in a complete test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NAVSANDA FORM 1209(2-PT)(1-64)

ALLOWANCE PARTS LIST (APL)

EQUIPMENT/COMPONENT NOMENCLATURE/CHARACTERISTICS
PUMP RTY PWR 35 GPM
17 PSI 2325 RPM

TECHNICAL DOCUMENT NUMBER
MANUAL 347-0056
PLAN

IDENTIFICATION NO. 017620128
DATE 01-15-68
PAGE 1

CHARACTERISTICS
MFR-CLEVELAND DIESEL ENGINE DIV OF GENERAL MOTORS CORP
BUSHIPS PLAN-YT149-S61-072
MFR DWG-NT10812
MFR IDENTIFICATION-PART NO 3307751
CAPACITY-35 GPM

PART REC · SOURCE · MAINT · RECOVERY · NOTES · QTY IN ONE EQPT/COMP. · U/I · ALLITEM

ON BOARD ALLOWANCE TABLE
NUMBER OF EQUIPMENTS/COMPONENTS
1 · 2 · 3 · 4 · 5-8 · 9-20 · 21-50

103320
113175
117061
131692
179816
3248386

ADDITIONAL PLAN NO/S

N21102
N21183
N21184

Item name	Stock no.	Part rec	Source	Maint	Recovery	Qty	U/I
PAPER-GSKT 1-64 THK	9Z5330-270-8468	3	M	2	C	2	SF
PIPE-BRS 3-8 IPS	9C4710-277-6079	3	M	2	C	1	FT
WASHER-LK STL 5-16 ID	9Z5310-010-3320	3	P	2	C	.1	HD
PLUG-PP BRS 1-8 IPS	9C4730-011-3175	3	P	2	C	3	EA
NUT-PLN HEX STL 5-16 18	9Z5310-550-4888	3	P	2	C	.1	HD
NUT-PLN CAP BRS 1-2 20	1H5310-013-1692	3	N	2	C	1	EA
BOLT-MACH HEX 5-16X3-4	9Z5306-550-1208	3	P	2	C	4	EA
IMPELLER-PMP	9C2930-364-3564	1	P1	2	C	1	EA

SEE SNSL FOR ALLOW

END

REFERENCE SYMBOL NO.		ITEM NAME	STOCK NO.
DD 0001	169	PART II	ALLOWANCE PARTS LIST (APL) SECTION A
SHIP TYPE & HULL NO.	PAGE		

017620128 IDENTIFICATION NO. · 01-15-68 DATE · 1 PAGE

Figure 7-3.—Allowance parts list (APL).

17.63

Table 7-2.—Data elements of the APL.

1. Equipment/Component Nomenclature/ Characteristics	Name of equipment or component and brief description. This corresponds to the Index entries.
2. Technical Document Number	The predominant technical manual or plan number. Additional numbers shown in item 8.
3. Identification Number	Nine digit identifying number assigned by SPCC to a particular item or component of equipment. This number is shown at top and bottom of page.
4. Date	COSAL publication date.
5. Page	Consecutive numbering of all pages required to describe one equipment/component which is identified by a single APL number. This is shown at both top and bottom of page. APLs have the word

Table 7-2. Data elements of the APL.–(Continued)

5. Page (Cont'd.)	"END" printed in the center of the page immediately following the last line of data for that APL. This ensures that a complete APL is available.
6. Characteristics	Complete nameplate data on the equipment/component names in item 1.
7. Reference/Symbol Number	A number, other than an FSN, by which a part may be identified, arranged in alpha/numeric sequence. It may be a manufacturer's part, drawing, piece, or circuit symbol number.
8. Additional Data Area	When additional technical manuals or plans are applicable, they are listed in this area under an appropriate caption. These are in addition to those listed in items 2 and 6.
9. Item Name	The name listing of repair parts and/or related accessory components for the equipment/component covered by the APL.
10. Stock Number	The FSN assigned to a specific repair part. When an FSN has not been assigned, the reference number from item 7 is repeated.
11. Part Military Essentiality Code (Part MEC)	There are two codes. They are shown on the APL and the SNSL. 1 - Failure of the part would have a major effect on the dependence/operation of the component. 3 - Failure of the part would have little effect on the dependence/operation of component.
12. Source Code	Indicates the availability of repair parts and method of procurement. These codes are defined in the Introduction.
13. Maintenance Code	A three digit code signifying the maintenance activity authorized to replace, repair, and condemn an item. Only first digit now used. These codes are defined in the Introduction.
14. Recoverability Code	Indicates the recoverability characteristics of items removed during maintenance. R - Repairable S - Salvageable C - Consumable

15. Notes Code	Provides necessary and important information about individual items listed on the APL. The Introduction lists and defines these codes.
16. Quantity in One Equipment/ Component	The total population of the part within the equipment/component described by the APL.
17. Unit of Issue	The smallest quantity of a stock item that can be issued.
18. Allowance Item Code	Reserved for future COSAL use.
19. On Board Allowance Table	APLs published as part of an allowance list for shipboard use will not have quantities printed in these columns. Instead, "SEE SNSL FOR ALLOW" will be printed. APLs which are received after the regular COSAL will have quantities shown.
20. Ship Type and Hull Number	The specific ship for which the APL is published.
21. Page	Consecutive page numbering from first page to last of all APL pages contained in the COSAL.

kit and enables one to replace items that have been used.

Stock Number Sequence List.—The Stock Number Sequence List is composed of two parts, Storeroom Items (SNSL-SRI) and Operating Space Items (SNSL-OSI). The SNSL-SRI is used by the supply officer in determining what repair parts to stock in his storerooms. The SNSL-OSI is used to determine the items required or generally used in maintaining engineering spaces and equipment. As stated earlier, the controlled equipage shown on the SNSL-OSI is a mandatory allowance, but the consumable items are listed only as a guide in requisitioning material.

Alternate Number Cross-Reference to Stock Number.—The cross-reference section contains all of the reference numbers (specification, plan, catalog, part, or type number) contained in the APLs and cross-references them to the current FSN if assigned.

Part III, Section E.—Section E is prepared by the Fleet Material Support Office and contains generally used, consumable, nonequipment related items and provides a guide for initial outfitting of a ship's operating spaces and storerooms. Normally, it will not be published for a COSAL resulting from a ship overhaul but is published only for new construction, major conversion, or reactivated ships.

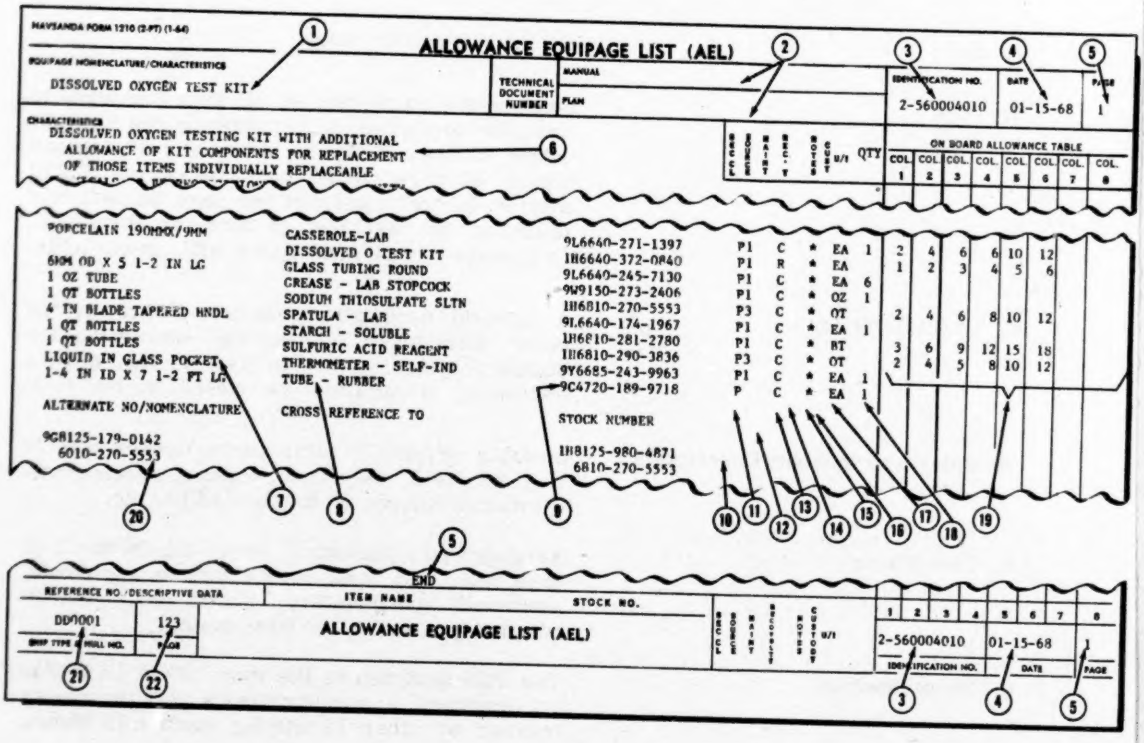
COSAL Maintenance.—The COSAL, just as any other Navy publication, frequently requires changes and corrections. Any errors discovered in the COSAL (APL still in COSAL for equipment that has been removed, equipment onboard but not supported by an APL, nameplate data in the APL does not agree with that shown on the equipment) should be reported promptly to the supply officer so that appropriate action may be taken to correct the COSAL. To ensure that repair part support is available in supply department storerooms, all equipment acquisitions and dispositions must be reported to the supply officer as they occur. The importance of doing this cannot be overstressed—very few things will cause as much grief for both the engineer officer and the supply officer as suddenly to discover in the middle of a deployment that there are no repair parts on board for a newly installed equipment.

Table 7-3.—Data elements of the AEL.

1. Equipage Nomenclature/ Characteristics	Name of equipage or the mechanical/electrical system.
2. Technical Document Number	The predominant technical manual and/or plan number. Additional numbers may be shown in items 6 and 7.
3. Identification Number	The number assigned to identify a specific AEL. The first digit followed by a dash (-) indicates the activity responsible for preparation and maintenance of the AEL and the general equipage significance. 0-SPCC-Ordnance material 1-SPCC-Space/system related material 2-SPCC-Miscellaneous material 3-SPCC-Automotive, construction, and material handling equipment 4-SPCC-Flag Allowance material 5-SPCC-Special Project Office material 6-SPCC-Special Propulsion Plant
4. Date	COSAL publication date.
5. Page	Consecutive numbering of all pages required to describe or system and covered by one identification number. This is shown at both top and bottom of page. AELS have the word "END" printed in the center of the page immediately following the last line of data for that AEL. This ensures that a complete AEL is available.
6. Characteristics	A general description, characteristics and/or other identifying information concerning the equipage/system named in item 1. May include additional information as stated in the text.
7. Reference Number/Descriptive Data	Contains significant information, manufacturer's part numbers, reference numbers, special comments and references to other AELS, etc.
8. Item Name	Arranged in alphabetical sequence, the name of each item; and when appropriate or applicable, additional nomenclature, dimensions, etc., to adequately describe the item named.
9. Stock Number	The FSN assigned to the item. When an FSN is not assigned, a manufacturer's part or catalog number or other identifying number is shown.
10. Security Classification Code	Reserved for future COSAL use.

Table 7-3.—Data elements of the AEL (Continued)

11. Source Code	Indicates the availability of the item and the method of procurement. These codes are defined in the Introduction.
12. Maintenance Code	Reserved for future COSAL use.
13. Recoverability Code	Indicates the recoverability characteristics of the item. R - Repairable S - Salvageable C - Consumable
14. Blank	Column reserved for future COSAL use.
15. Notes Codes	Provides necessary and important information about individual items on the AEL. The introduction lists and defines these codes.
16. Custody Code	Reserved for future COSAL use.



NAVSANDA FORM 1210 (2-PT) (1-64)

ALLOWANCE EQUIPAGE LIST (AEL)

EQUIPAGE NOMENCLATURE/CHARACTERISTICS: DISSOLVED OXYGEN TEST KIT

TECHNICAL DOCUMENT NUMBER: MANUAL / PLAN

IDENTIFICATION NO.: 2-560004010

DATE: 01-15-68

PAGE: 1

CHARACTERISTICS: DISSOLVED OXYGEN TESTING KIT WITH ADDITIONAL ALLOWANCE OF KIT COMPONENTS FOR REPLACEMENT OF THOSE ITEMS INDIVIDUALLY REPLACEABLE

			SEC CL	SOURCE	MAINT	REC-T	NOTES	CUST	U/I	QTY	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7	COL. 8
POPCELAIN 190MMX/9MM	CASSEROLE-LAB	9L6640-271-1397		P1		C	*		EA	1	2	4	6	6	10	12		
	DISSOLVED O TEST KIT	1H6640-372-0840		P1		R	*		EA		1	2	3	4	5	6		
6MM OD X 5 1-2 IN LG	GLASS TUBING ROUND	9L6640-245-7130		P1		C	*		EA	6								
1 OZ TUBE	GREASE - LAB STOPCOCK	9W9150-273-2406		P1		C	*		OZ	1								
1 QT BOTTLES	SODIUM THIOSULFATE SLTN	1H6810-270-5553		P3		C	*		QT		2	4	6	8	10	12		
4 IN BLADE TAPERED HNDL	SPATULA - LAB	9L6640-174-1967		P1		C	*		EA	1								
1 QT BOTTLES	STARCH - SOLUBLE	1H6810-281-2780		P1		C	*		BT		3	6	9	12	15	18		
1 QT BOTTLES	SULFURIC ACID REAGENT	1H6810-290-3836		P3		C	*		QT		2	4	5	8	10	12		
LIQUID IN GLASS POCKET	THERMOMETER - SELF-IND	9Y6685-243-9963		P1		C	*		EA	1								
1-4 IN ID X 7 1-2 FT LG	TUBE - RUBBER	9C4720-189-9718		P		C	*		EA	1								

ALTERNATE NO/NOMENCLATURE	CROSS REFERENCE TO	STOCK NUMBER
9G8125-179-0142		1H8125-980-4871
6010-270-5553		6810-270-5553

END

REFERENCE NO./DESCRIPTIVE DATA		ITEM NAME / STOCK NO.	SEC CL	SOURCE	MAINT	RECOVBLTY	NOTES	CUSTODY	U/I	1	2	3	4	5	6	7	8
DD0001	123	ALLOWANCE EQUIPAGE LIST (AEL)								2-560004010				01-15-68			1
SHIP TYPE & HULL NO.	PAGE									IDENTIFICATION NO.				DATE			PAGE

Figure 7-4.—Allowance equipage list (AEL).

123.2

Table 7-3.—Data elements of the AEL (Continued)

17. Unit of Issue	The smallest quantity of a stock item that can be issued.
18. Quantity	Normally blank. See text for additional information.
19. On Board Allowance Table	Consists of eight numbered columns in which quantities may be shown. In certain cases, the total shipboard allowance quantity is determined by the sum total of quantities appearing in designated columns of several AELs. The COSAL Index will show all applicable AEL numbers and the appropriate column for each. The abbreviation "AR" (As Required) may appear in lieu of a quantity. Information as to quantity allowed will then be contained elsewhere in the AEL.
20. Additional Data Area	When appropriate or applicable, additional data will be listed in this area under an appropriate machine inserted caption. These data include, but are not limited to, NavShip numbers, plan numbers, technical manual numbers, and Alternate No./Nomenclature - Cross Reference to-Stock number.
21. Ship Type and Hull No.	The specific ship for which the AEL is published.
22. Page	Consecutive page numbering from first page to last page of all AEL pages published in the COSAL.

A further check later on to see that the repair parts required by the new APL are either on order or already on board is merely a prudent precaution, and this should be done either by the petty officer who draws repair parts from the supply storeroom or by the leading petty officer in charge of the equipment in question.

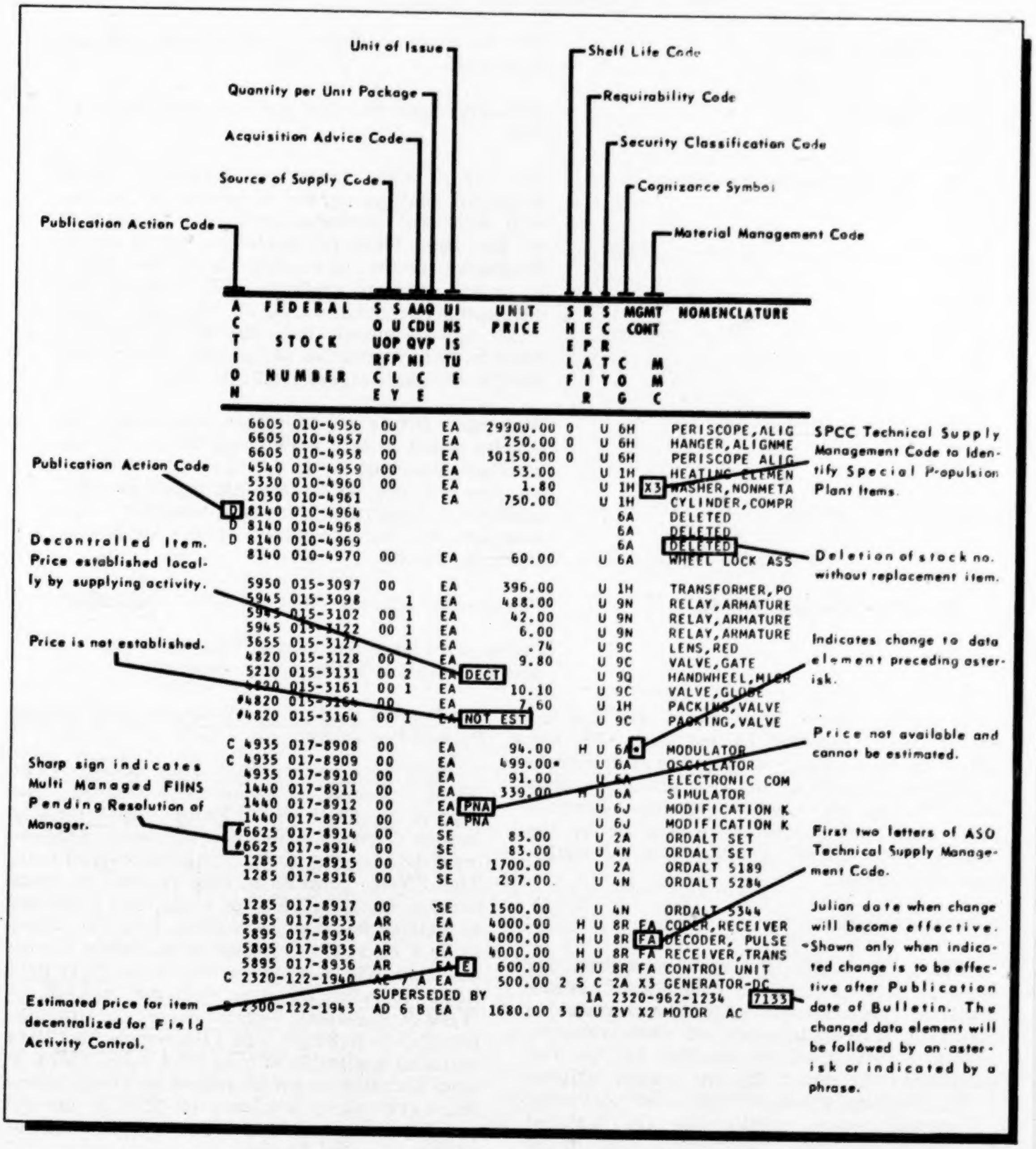
NavSup Publications

Since the submission of a requisition for supplies sets in motion a long chain of events involving procurement actions, movement of material, and maintenance of stock records, accurate data must be supplied by the requisitioner in order for the supply activity to fill the requisition promptly and correctly.

Several related publications are designed to provide accurate management data to the end users of materials. The format and use of these publications is described in the Introduction to the Navy Management Data List and Related Publication, Federal Supply Catalog Section C-1 (Navy).

Navy Management Data List (NMDL).—The NMDL consists of two separate sections. The first is the NMDL itself, Federal Supply Catalog Section C-ML-N, which contains basic management data necessary for preparing requisitions. The NMDL consists of data relative to stock number changes, units of issue, unit price and associated information (see fig. 7-5). The NMDL is kept current by means of bimonthly change bulletins. The second section is the Fleet Ballistic Missile Weapons Systems Supplement (FBM Supplement), Federal Supply Catalog Section C-ML-N (FBM). The FBM Supplement lists material applicable only to FBM submarines. It also includes a cross-reference from manufacturers' parts numbers to FSN in the 8P cognizance material, and is distributed only to FBM Submarine Forces.

Master Cross-Reference List (MCRL).—The MCRL, Federal Supply Catalog Section C-RL-N,



Unit of Issue
Quantity per Unit Package
Acquisition Advice Code
Source of Supply Code
Publication Action Code
Shelf Life Code
Requirability Code
Security Classification Code
Cognizance Symbol
Material Management Code

```
A  FEDERAL    S S AAQ UI   UNIT    S R S  MGMT  NOMENCLATURE
C             O U CDU NS   PRICE   H E C  CONT
T   STOCK     UOP QVP IS           E P R
I             RFP NI  TU           L A T C   M
O   NUMBER    C L  C   E           F I Y O   M
N             E Y  E                 R   G   C

   6605 010-4956  00      EA   29900.00 0   U 6H     PERISCOPE,ALIG
   6605 010-4957  00      EA     250.00 0   U 6H     HANGER,ALIGNME
   6605 010-4958  00      EA   30150.00 0   U 6H     PERISCOPE ALIG
   4540 010-4959  00      EA      53.00     U 1H     HEATING ELEMEN
   5330 010-4960  00      EA       1.80     U 1H X3  WASHER,NONMETA
   2030 010-4961          EA     750.00     U 1H     CYLINDER,COMPR
 D 8140 010-4964                              6A     DELETED
 D 8140 010-4968                              6A     DELETED
 D 8140 010-4969                              6A     DELETED
   8140 010-4970  00      EA      60.00     U 6A     WHEEL LOCK ASS

   5950 015-3097  00      EA     396.00     U 1H     TRANSFORMER,PO
   5945 015-3098      1   EA     488.00     U 9N     RELAY,ARMATURE
   5945 015-3102  00  1   EA      42.00     U 9N     RELAY,ARMATURE
   5945 015-3122  00  1   EA       6.00     U 9N     RELAY,ARMATURE
   3655 015-3127      1   EA        .74     U 9C     LENS,RED
   4820 015-3128  00  1   EA       9.80     U 9C     VALVE,GATE
   5210 015-3131  00  2   EA DECT           U 9Q     HANDWHEEL,MICR
   4820 015-3161  00  1   EA      10.10     U 9C     VALVE,GLOBE
  #4820 015-3164  00      EA       7.60     U 1H     PACKING,VALVE
  #4820 015-3164  00  1   EA NOT EST        U 9C     PACKING,VALVE

 C 4935 017-8908  00      EA      94.00   H U 6A *   MODULATOR
 C 4935 017-8909  00      EA     499.00*    U 6A     OSCILLATOR
   4935 017-8910  00      EA      91.00     U 6A     ELECTRONIC COM
   1440 017-8911  00      EA     339.00   H U 6A     SIMULATOR
   1440 017-8912  00      EA PNA            U 6J     MODIFICATION K
   1440 017-8913  00      EA PNA            U 6J     MODIFICATION K
  #6625 017-8914  00      SE      83.00     U 2A     ORDALT SET
  #6625 017-8914  00      SE      83.00     U 4N     ORDALT SET
   1285 017-8915  00      SE    1700.00     U 2A     ORDALT 5189
   1285 017-8916  00      SE     297.00     U 4N     ORDALT 5284

   1285 017-8917  00      SE    1500.00     U 4N     ORDALT 5344
   5895 017-8933  AR      EA    4000.00   H U 8R FA  CODER,RECEIVER
   5895 017-8934  AR      EA    4000.00   H U 8R FA  DECODER, PULSE
   5895 017-8935  AR      EA    4000.00   H U 8R FA  RECEIVER,TRANS
   5895 017-8936  AR      EA E   600.00   H U 8R FA  CONTROL UNIT
 C 2320-122-1940  AC 7 A  EA     500.00 2 S C 2A X3  GENERATOR-DC
                  SUPERSEDED BY             1A 2320-962-1234   7133
   2500-122-1943  AD 6 B  EA    1680.00 3 D U 2V X2  MOTOR  AC
```

Publication Action Code

Decontrolled Item. Price established locally by supplying activity.

Price is not established.

Sharp sign indicates Multi Managed FIINS Pending Resolution of Manager.

Estimated price for item decentralized for Field Activity Control.

SPCC Technical Supply Management Code to Identify Special Propulsion Plant Items.

Deletion of stock no. without replacement item.

Indicates change to data element preceding asterisk.

Price not available and cannot be estimated.

First two letters of ASO Technical Supply Management Code.

Julian date when change will become effective. -Shown only when indicated change is to be effective after Publication date of Bulletin. The changed data element will be followed by an asterisk or indicated by a phrase.

Figure 7-5.—Navy Management Data List (NMDL).

63.51

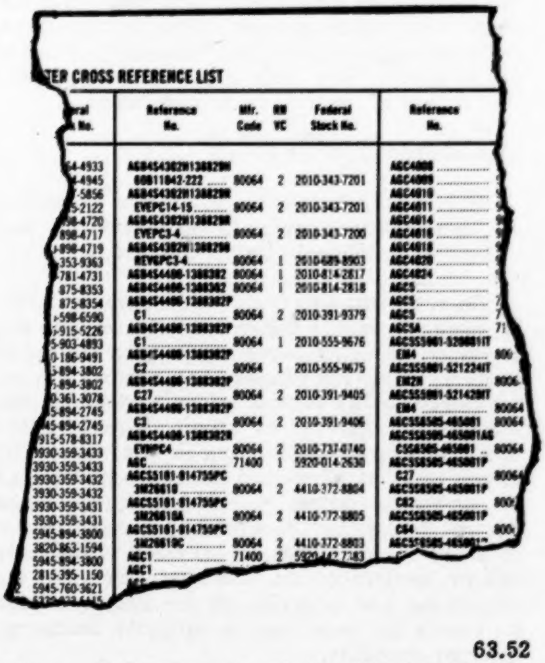
148

is designed to provide a cross-reference from a reference number (manufacturer's part number, a drawing number, design control number, etc.) to its assigned FIIN. The format of the MCRL is illustrated in figure 7-6. The FSCM shown in figure 7-6 is an identification number assigned to all manufacturers doing business with the Department of Defense and is necessary to differentiate between identical reference numbers assigned by different manufacturers.

Deleted and Superseded FIIN List (DSFL).—The DSFL, NavSup P-4200, is the historical record of stock number changes and deletions. It is distributed with the basic NMDL and is kept current by the NMDL bulletin.

Consolidated Repairable Item List (CRIL).—The CRIL, NavSup P-4102, is prepared to assist in identifying Navy managed mandatory turn-in repairable items and pertinent movement priority designators. The CRIL is published annually and is printed in FIIN sequence. Changes are contained in bimonthly bulletins.

Illustrated Shipboard Shopping Guide (ISSG.—The ISSG, NavSup P-4400, is designed to assist fleet personnel in identifying to an FSN, those items of supply not normally related to a part or reference number. The ISSG also provides assistance in determining substitutions in the general hardware area through the use of illustrations, specifications and narrative descriptions from which the applicable FSNs can be determined. Sections of the ISSG are republished when the volume of changes is significant.



TER CROSS REFERENCE LIST

Reference No.	Mfr. Code	RR VC	Federal Stock No.
AGB4S4302H1388298			
80B11042-222	80064	2	2010-343-7201
AGB4S4302H1388298			
EVEPC14-15	80064	2	2010-343-7201
AGB4S4302H1388298			
EVEPC3-4	80064	2	2010-343-7200
AGB4S4302H1388298			
REVEPC3-4	80064	1	2010-689-8903
AGB4S4400-1388382	80064	1	2010-814-2817
AGB4S4400-1388382	80064	1	2010-814-2818
AGB4S4400-1388382P			
C1	80064	2	2010-391-9379
AGB4S4400-1388382P			
C1	80064	1	2010-555-9676
AGB4S4400-1388382P			
C2	80064	1	2010-555-9675
AGB4S4400-1388382P			
C27	80064	2	2010-391-9405
AGB4S4400-1388382P			
C3	80064	2	2010-391-9406
AGB4S4400-1388382R			
EVEPC4	80064	2	2010-737-0740
AGC	71400	1	5920-014-2630
AGCS5101-014755PC			
3M26610	80064	2	4410-372-8804
AGCS5101-014755PC			
3M26610A	80064	2	4410-772-8805
AGCS5101-014755PC			
3M26610C	80064	2	4410-372-8803
AGC1	71400	2	5920-142-7383
AGC1			

63.52

Figure 7-6.—Format of the Master Cross-Reference List (MCRL).

Other Sources of Identification

There will be times when the repair part required is not listed in an APL. This may happen when the equipment/component is not supported or when the part has been omitted from the APL. Keep in mind that an APL may cover a complete equipment or only a component of an equipment. Therefore the index should be checked to ascertain if the needed part might be included in another APL. For example; couplings, switches, and valves may be listed in the APLs for the components with which they are used, or each may be assigned a CID number and have its own APL.

To identify a repair part requirement in other than the COSAL, complete information on the equipment must be known. There are several sources for this information.

Nameplate Data.—One of the most important sources of information is the data shown on equipment nameplate. This may include manufacturer's name, model or type and serial, size or capacity, voltage, et cetera.

Technical Manuals.—Technical manuals and instruction book published by the equipment manufacturer usually contain complete descriptions of the equipment as well as parts lists which identify the part to a manufacturer's part number.

Blueprints and Drawings.—Installation and maintenance blueprints and drawings also contain identifying information that may be helpful in identifying the requirement.

SUPPLY OVERHAUL

When the ship has been definitely assigned to a shipyard for regular overhaul, the Fleet Material Support Office (FMSO) will normally schedule a supply availability to be conducted

149

at the same time. Letters are sent to the commanding officer of the ship and the inventory control points (ICPs) containing the dates and the activity to assist the ship. This assistance is accomplished through the Supply Operations Assistance Program (SOAP).

Validation is the physical inventory of all equipment on board and the matching of that inventory with the records of installed equipment held by the ICPs (ESO and SPCC).

When the ICPs receive the assignment letter from FMSO, each of them prepares validation aids based on their master index of installed equipment for a ship. The validation does not include equipage and operating space items covered by AELs.

The ESO validation aids consist of a Preliminary Equipment/Component Index (PECI) and complete instructions for entering corrections. The PECI is the detailed listing of each item of electronic equipment showing nomenclature, voltage, serial number, APL number, and shipboard location.

SPCC validation aids consist of a new "B" Index and a set of 5" x 8" cards covering every equipment/component listed in the index. The cards contain the equipment/component nomenclature, APL number, service application, and quantity as shown in the index plus complete characteristics as shown on the APL. Complete instructions are included in the validation package.

The actual work of sighting each item, comparing the nameplate data with that shown on the validation aid, and making necessary corrections is normally done by the ship's department that is responsible for maintaining the equipment. The executive officer with the assistance of a "coordination desk" established by the engineer officer (operations officer when validating electronic equipment) usually is responsible for coordinating the validation and reporting all corrections to the ICP as per the instructions. These corrections cover equipment removed from the ship, new equipment received, changes in nameplate data, changes in quantity, or changes to service application.

The important thing to remember about validation--the new COSAL will only be as good as the individual validation. The corrections sent back to ESO and SPCC are used to correct the master index, and from that, the new COSAL is prepared.

The supply overhaul is the work that is accomplished during a supply availability and begins concurrently with the shipyard overhaul. The work consists of offloading repairs parts, identification, inspection, inventory, repackaging, and preservation as needed, and is performed by Storekeepers and technical ratings from other departments as needed. Since the engineering department is responsible for most installed equipment, they will have a major role in validating the equipment and will probably be asked to provide one or more experienced petty officers to aid supply in the supply overhaul.

A good validation ensures a good COSAL, and a good supply overhaul purifies the stock of repair parts carried in supply department storerooms.

REPAIR PARTS PROCEDURES/ PROCUREMENT

A primary mission of the supply department is to maintain adequate stocks of repair parts and consumables to meet the demands of the ship. To do this requires a cooperative effort between the supply department and the other departments. Procedures now in effect are much more complicated than those of a few years ago, since greater demands have been made in reporting material consumption and in accounting. It may often seem that the supply department is floundering in paperwork.

CLASSIFICATION OF SHIPS

For supply purposes, ships are classified as "ships with Supply Corps Officers" and "ships without Supply Corps Officers."

On ships with Supply Corps Officers, material is stored in supply department storerooms and is issued to using departments upon receipt of properly prepared request. Some material may be stored in the custody of other departments when bulk, weight, or other characteristics make it impossible to use supply spaces. In either case, stock record cards are maintained by supply personnel and for material in the custody of another department, a duplicate set of stock record cards is provided to the petty officer designated as custodian. Detailed instructions are provided by the supply officer to enable the custodian to properly discharge his responsibility.

On ships without Supply Corps Officers, a line officer is designated by the commanding

150

officer to serve as the supply officer. Storage space varies from ship to ship, but generally the number of repair parts that can be maintained by the supply department is limited. Thus, most repair parts may be stored in the custody of the cognizant department under the control of a designated custodian. The custodian is responsible for proper expenditure of material in his custody and for submitting properly prepared issue documents to the supply department covering all material issues.

ISSUES FROM SUPPLY DEPARTMENT STOREROOMS

The NavSup Form 1250 is used on all nonmechanized ships (that is, ships not using electronic data processing equipment) to request material and record material consumption. Mechanized ships use the DD Form 1348 as an internal issue document.

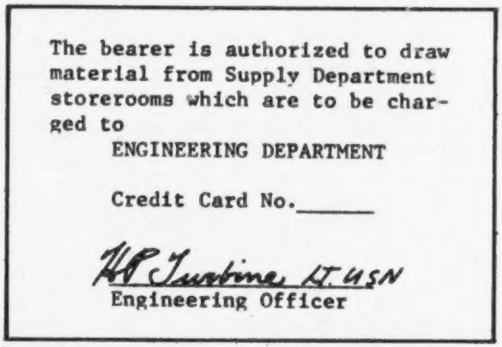
Routine issues of repair parts and consumable items are made only to persons authorized in writing by the head of department. This authorization may be by memo or letter to the supply officer naming these individuals authorized to draw material, or a "credit card" system may be used. The "credit card" is a locally developed form similar to the one shown in figure 7-7 and is controlled by the head of department. It is advisable to limit the number of persons authorized to draw material in order to maintain better control of and obtain maximum benefits from the department budget.

SPECIAL REQUIREMENTS

Generally, repair parts are carried on board in the quantities authorized by the COSAL, and consumables are stocked on the basis of past usage. Any special requirements for material should be submitted to the supply officer well ahead of the time they will be needed. Special requirements may be either for material in a greater quantity than is normally stocked by supply or for material that is not stocked by supply.

PREPARATION OF NAVSUP 1250

Requests for material are submitted on Single Line Item Consumption/Management Document (Manual), NavSup 1250. This form was developed to meet two needs: (1) improved stock control procedures and (2) reporting consumption under the Maintenance Data Collection System (MDCS) of the Standard Navy Maintenance and Material Management System (SNMMMS), usually referred to as 3M.



The bearer is authorized to draw
material from Supply Department
storerooms which are to be charged to
ENGINEERING DEPARTMENT

Credit Card No.______

H.P. Turbine LT. USN
Engineering Officer

63.53

Figure 7-7.—"Credit card" authorization to draw stores from supply department storerooms.

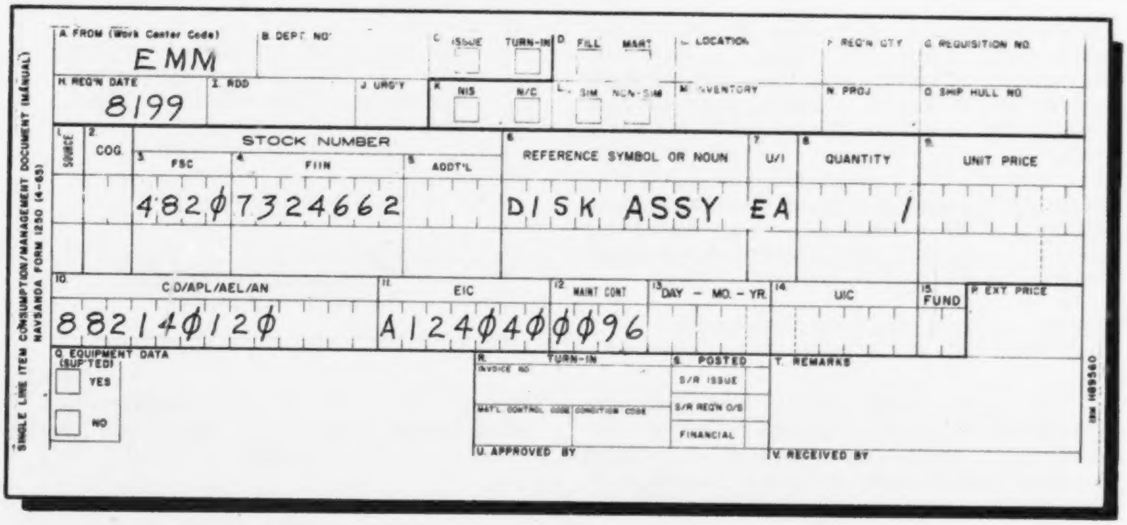
The department representative may present a partially prepared NavSup 1250, or the form may be completely prepared by supply personnel, depending upon supply department instructions and existing conditions aboard ship. In either case, certain information must be furnished by the department representative. Figure 7-8 shows a partially prepared NavSup 1250 containing the data that must be provided at the time the request is submitted to supply. The notation "MDCS only" denotes data elements that apply only to ships reporting under the MDCS. Ships not reporting under MDCS may omit those data.

When the material is received, the department representative receipts for it on the NavSup 1250 and is given the yellow copy of the form.

When material is drawn from stock, the "Approved by" signature (block U) is not required since the engineer officer has already authorized certain persons to draw material either by memo or credit card.

USE OF THE NAVSUP 302

Unfortunately, not all repair parts required to maintain engineering equipment have FSNs nor are they carried in the supply system. This is largely due to two factors: age of some equipment and the fact that some equipment is supplied by many different manufacturers. It is just not practical to invest large sums of money



SINGLE LINE ITEM CONSUMPTION/MANAGEMENT DOCUMENT (MANUAL)
NAVSANDA FORM 1250 (4-65)

A. FROM (Work Center Code): EMM
B. DEPT. NO.:
C. ☐ ISSUE ☐ TURN-IN
D. FILL MART
E. LOCATION
F. REQ'N QTY
G. REQUISITION NO.
H. REQ'N DATE: 8199
I. RDD
J. URG'Y
K. ☐ NIS ☐ N/C
L. ☐ SIM ☐ NON-SIM
M. INVENTORY
N. PROJ
O. SHIP HULL NO.

1. SOURCE	2. COG.	STOCK NUMBER 3. FSC	4. FIIN	5. ADDT'L	6. REFERENCE SYMBOL OR NOUN	7. U/I	8. QUANTITY	9. UNIT PRICE
		4820	7324662		DISK ASSY	EA	1	

10. C.D/APL/AEL/AN	11. EIC	12. MAINT CONT	13. DAY – MO. – YR.	14. UIC	15. FUND	P. EXT PRICE
88214012 0	A124040	0096				

Q. EQUIPMENT DATA (SUP'TED) ☐ YES ☐ NO
R. TURN-IN: INVOICE NO. / MAT'L CONTROL CODE / CONDITION CODE
S. POSTED: S/R ISSUE / S/R REQ'N O/S / FINANCIAL
T. REMARKS
U. APPROVED BY
V. RECEIVED BY

DATA BLOCK	INFORMATION TO BE SHOWN
A	Work center code (MDCS only) or appropriate local identification code.
H	Julian date that the request is submitted.
3-4-5	FSN and TSMC if applicable.
6	Circuit symbol and noun name of repair part for electronic equipment or noun name for all other material.
7	Unit of issue.
8	Quantity required.
10-11-12	(MDCS only) These blocks must be completed for all material required to support a maintenance action. Leave blank for consumable supplies.
10	The COSAL APL/AEL number of equipment for which the material is needed.
11	The equipment identification code.
12	The maintenance control number for the maintenance action.

17.84

Figure 7-8.—Single Line Item Consumption/Management Document (Manual), NavSup 1250, with information supplied by the department representative.

in inventory of repair parts that have limited application and usage.

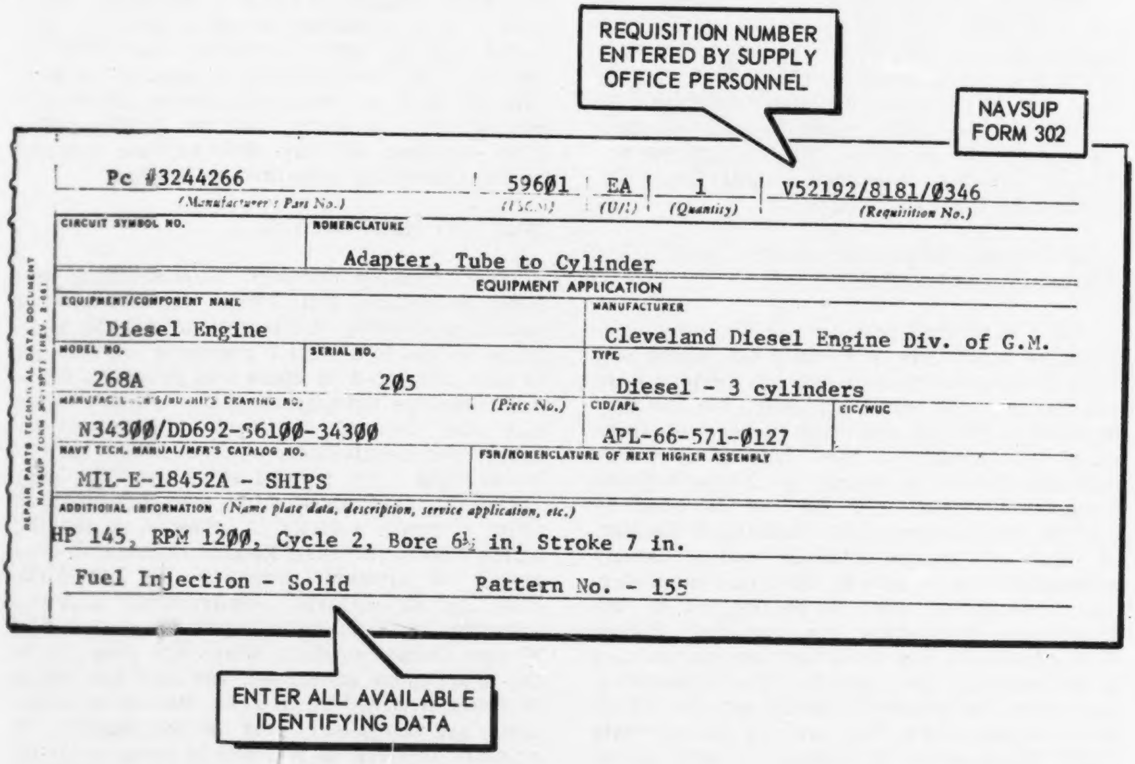
When a repair part is required for which no FSN can be determined, the part must be ordered with the manufacturer's part or reference number as its identification. To ensure that the supply activity has sufficient information to process the requisition, the NavSup 302 should be submitted with the NavSup 1250. Supply then forwards the original of the NavSup 302 with the requisition to the supply activity. An example of the NavSup 302 is illustrated in figure 7-9. With the information contained therein, the supply activity can cross the part to an FSN if one is assigned or purchase the part direct from the manufacturer.

NIS/NC TRANSACTIONS

As indicated above, not all requirements for repair parts can be satisfied by storeroom stock. Some items will be "not carried" (NC) and others "not in stock" (NIS). When this occurs, the supply department uses the NavSup 1250 to prepare a direct turnover (DTO) requisition for the material.

When a DTO requisition is prepared for NIS/NC material, an approval signature is required on the NavSup 1250 and the urgency of need designator must be assigned in block J. The urgency of need designator is one of the elements used by supply in determining what priority to assign to the requisition and is discussed later in the chapter. It also indicates the person that is authorized to sign the NavSup 1250 as shown below. Also shown is the MAXIMUM supply response time as established by NavSup.

Each time a request for repair parts is NIS/NC, it affords an opportunity to verify the accuracy of the COSAL. Block Q of the NavSup 1250 must be marked to indicate whether or not the COSAL supports the equipment. If it does not, full nameplate data of the equipment, its service application, and the quantity installed should be reported promptly to the supply officer so that he can report the correction to the ICP. The importance of this verification should be impressed upon all men in



REQUISITION NUMBER ENTERED BY SUPPLY OFFICE PERSONNEL

NAVSUP FORM 302

Pc #3244266 (Manufacturer's Part No.) | 59601 (FSCM) | EA (U/I) | 1 (Quantity) | V52192/8181/0346 (Requisition No.)

CIRCUIT SYMBOL NO.:

NOMENCLATURE: Adapter, Tube to Cylinder

EQUIPMENT APPLICATION

EQUIPMENT/COMPONENT NAME: Diesel Engine

MANUFACTURER: Cleveland Diesel Engine Div. of G.M.

MODEL NO.: 268A

SERIAL NO.: 205

TYPE: Diesel - 3 cylinders

MANUFACTURER'S/BUSHIPS DRAWING NO. (Piece No.): N34300/DD692-S6100-34300

CID/APL: APL-66-571-0127

EIC/WUC:

NAVY TECH. MANUAL/MFR'S CATALOG NO.: MIL-E-18452A - SHIPS

FSN/NOMENCLATURE OF NEXT HIGHER ASSEMBLY:

ADDITIONAL INFORMATION (Name plate data, description, service application, etc.)

HP 145, RPM 1200, Cycle 2, Bore 6½ in, Stroke 7 in.

Fuel Injection - Solid Pattern No. - 155

REPAIR PARTS TECHNICAL DATA DOCUMENT

ENTER ALL AVAILABLE IDENTIFYING DATA

7.2

Figure 7-9.—Repair Parts Technical Data Document, NavSup 302.

153

Table 7-4.—Assignment of Urgency of Need Designators by Shipboard Departments.

Urgency	Signature Required	Supply Department Response Time	
		Material on board Issue Time	Material NIS/NC Requisition Release Time
A	Head of Department	1 hour	2 hours
B	Head of Department or designated officer	2 hours	2 hours
C-D	Department Representative for repair parts and NIS consumables. Department head for equipage and NC consumables.	24 hours	24 hours

the engineering department who are authorized to prepare requests.

Not-carried material may be ordered only for DTO and only when it is required for immediate use. Repair parts and consumables which are not allowed by the COSAL and/or usage can be ordered for stock ONLY by submitting an in-excess requisition via the type commander for approval. The criteria for in-excess and not in-excess requisitions are discussed later in the chapter.

UNIFORM MATERIAL MOVEMENT AND ISSUE PRIORITY SYSTEM

All requisitions prepared by the supply department must have a priority designator assigned. The priority designator is derived from two factors; one which classifies the military importance of the ship and the second which rates the urgency of need. The military importance factor is called the Force/Activity Designator (FAD). It may be assigned by the type commander, fleet commander, SecNav, or other designated authority and is usually promulgated to the ship by the type commander. The urgency of need is determined by the department requesting the material. Figure 7-10 illustrates how these two factors are used in determining the priority. The illustration also shows the priority delivery date for CONUS and overseas units. The priority delivery date (PDD) is computed by adding the days, shown in the appropriate column for the urgency of need assigned, to the date of the requisition. For example; a ship is in FAD III and the engineer officer has been assigned UND "B" to give a priority of 06 to a requisition dated 8194. The maximum standard delivery date would then be 8202 for CONUS and 8209 for overseas. If the material is required sooner than the PDD, a required delivery date should be indicated in block I of the NavSup 1250. This required delivery date is then entered on the requisition submitted by supply.

MILSTRIP REQUISITIONS

The Military Standard Requisitioning and Issue Procedure, MILSTRIP, was developed to permit processing of requisitions by EAM/ADP. Much of the information formerly written out is now converted to codes that provide a common language between all of the Armed Forces and the General Services Administration. MILSTRIP requisitions are submitted on DD Form 1348 for manual ships and DD Form 1348m for mechanized ships. Material received from a supply activity is invoiced on the DD Form 1348-1 (Release/Receipt Document). The supply department prepares the DD Form 1348 for all material requirements with the exception of ammunition, medical supplies, and Marine Corps supplies, which are ordered by the department concerned, and bulk fuel which is ordered on DD Form 1149. Fuel oil requisitions are discussed later in the chapter. Of primary concern to you will be material which is ordered DTO in response to an NIS/NC request. The NavSup 1250 is the source document

ISSUE PRIORITY DESIGNATORS

("Force/Activity Designator" - "Urgency of Need" Conversion Table)

URGENCY OF NEED DESIGNATOR (UND)	FORCE/ACTIVITY DESIGNATOR (FAD)					PRIORITY DELIVERY DATE (PDD)	
	I	II	III	IV	V		
	ISSUE PRIORITY DESIGNATOR (IPD)					CONUS	OVERSEAS
DESIGNATOR A Emergency requirements for non-available materiel without which the Force/Activity concerned is unable to perform assigned missions or tasks.*	01	02	03			5 days (120 hrs)	7 days (168 hrs)
				07	08	8 days	15 days
DESIGNATOR B Requirements for non-available materiel which impairs the capability of the Force/Activity concerned. Missions can be performed, but with decreased operational effectiveness and efficiency.*	04	05	06			8 days	15 days
				09	10	20 days	45 days
.DESIGNATOR C Materiel requirements needed on a more urgent basis than routine, (e.g., immediate end use requirements for repair of collateral and administrative support equipment, to meet scheduled deployment, deficiencies in newly established outfitting or allowance lists.)*	11	12	13	14	15	20 days	45 days
DESIGNATOR D Material requirements for initial outfitting and filling of allowances, scheduled maintenance, routine stock replenishment, repair or maintenance of supply systems stocks.*	16	17	18	19	20	30 days	60 days

*FOR ADDITIONAL DETAILED GUIDANCE CONCERNING CRITERIA FOR SELECTING URGENCY OF NEED DESIGNATORS, SEE THE APPROPRIATE TABLE IN OPNAV INST 4614.1 (SERIES).

10.66

Figure 7-10.—Issue priority designators.

for preparation of the DD Form 1348. The yellow copy of the NavSup 1250 is returned to the department representative when it is determined that the requested material is NIS or NC and a DTO requisition must be prepared. After the requisition has been prepared by supply personnel, the requisition number is indicated in block G of the NavSup 1250, and the red copy is returned to the requesting department with the weekly budget report.

Bearer Requisition

While in port, urgent requirements that are available locally may be procured by use of a "bearer" (walk through) requisition. By this method, after the requisition has been prepared by supply personnel the ship's representative takes it to the supply activity, walks it through the processing steps, and receives the material. This system is restricted to higher priorities and should be used only when necessary.

Message Requisition

Requisitions may be submitted by naval message when their transmission by air mail will not result in the delivery of material by the time required. The decision to use a message requisition must be based on location of the ship (deployed or in port), location of the material (local or distant supply activity), and urgency of need.

Requisition Status and Followup

Status, as the name implies, refers to the status of an individual requisition at the supply activity. There are different types of status information available, but the most common is "exception" status. By this, the supply activity advises the requisitioner of any action taken except supplying and shipping the material. This may be back-order, passing the requisition to another supply activity, FSN change, FSN substitution, et cetera. If it is considered advisable to receive complete status on a high priority requirement, the supply officer should be requested to use the appropriate code on the requisition. Status may be received on a DD Form 1348m, message, or speedletter and is normally filed with the requisition copy in the Outstanding Requisition File in the supply office. Since the requisition number is entered on the red copy of the NavSup 1250, it is a simple matter to determine the present status of an individual requisition. When status or material has not been received by the priority delivery date, a followup may be submitted to the last known holder of the requisition.

In-Excess Requisitions

The supply officer has authority to submit all requisitions that are not in-excess directly to the appropriate supply activity. In-excess requisitions must be submitted via the type commander, and for certain designated items, to the cognizant bureau or material command, for approval before the items may be issued to the ship. The commanding officer is responsible for proper submission of requisitions. He, in turn, holds the supply officer responsible for determining what requisitions are in-excess, that they are so identified, and are approved by the appropriate higher authority.

All heads of departments must, to some extent, share in this responsibility since they must justify any requirements considered in-excess.

Requisitions for the following are considered in-excess:

1. Controlled equipage not on the ship's allowance list.
2. Controlled equipage on the allowance list but in greater quantities than allowed.
3. Nonstandard consumable supplies when similar items are available in the supply system.
4. Repair parts not listed in ship's allowance for which a requirement can be justified.

Not In-Excess Requisitions

Requisitions for the following are considered as not in-excess:

1. Controlled equipage on the allowance list not in a greater quantity than necessary to bring the amount on order and on hand up to full allowance.
2. Repair parts listed with or without quantities in the ship's allowance for which a requirement can be justified above the quantity fixed by the allowance.
3. Consumable supplies listed in the Navy Stock Lists, applicable allowance lists, or other consumable supplies except nonstandard items.
4. Material other than consumable supplies required for immediate expenditure for repairs

or alterations or to replace material so expended.

5. Services which cannot be accomplished by ship's force.

6. Equipage items that are not controlled equipage.

Fuel Requisitions

While the responsibility for procuring supplies of fuels rests with the supply officer, the engineer officer is responsible for determining the requirements. He advises the supply officer of the quantity of fuel oil required and the time delivery is desired.

Fuel is normally procured from one of the following sources:

1. Fleet oilers, station tankers, yard oilers, and tankers.
2. Fuel depots and annexes.
3. Commercial shore installations, both foreign and domestic, under Defense Petroleum Supply Center and local contracts.
4. Other Navy combatant or service force ships.
5. Shore installations of other services or agencies.

In an emergency, the supply officer may procure fuel from United States commercial vessels, foreign naval vessels, foreign naval shore establishments, foreign commercial vessels, or foreign commercial shore establishments not currently under DPSC or local Navy contracts.

CONTROLLED EQUIPAGE PROCEDURES

Controlled equipage is defined as items of equipage which have been designated to receive increased management control because of high unit cost, vulnerability to pilferage, and/or essentiality to the ship's mission. The equipage items so designated are listed in Appendix II of NavSup Manual volumes III and VIII. Custody signature of the head of department is required for all items marked by an asterisk in the above lists.

Most allowances of controlled equipage used by the engineering department will be contained in the SPCC COSAL Stock Number Sequence List - Operating Space Items and NavShips COSAL. These sources provide the allowance authority, nomenclature, FSN, and allowed quantity for a ship.

EQUIPAGE STOCK CARD AND CUSTODY RECORD

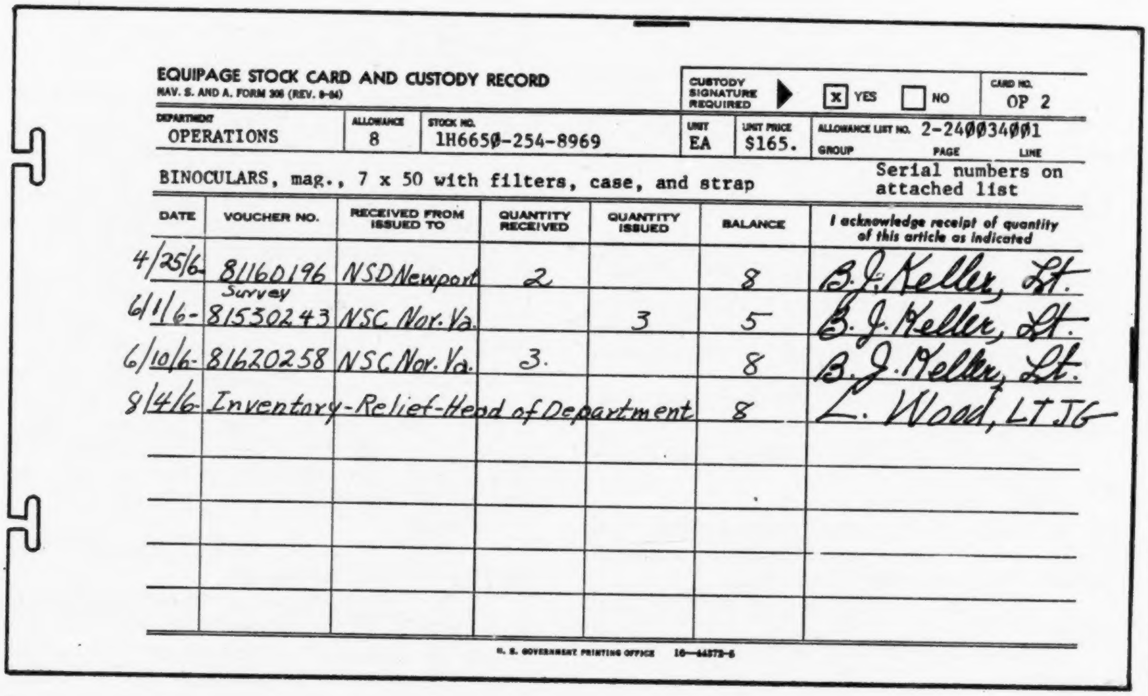
The Equipage Stock Card and Custody Record (NavSup 306 or NavSup 460) is designed to serve a dual purpose; as a custody record and an inventory control document. Its use is mandatory for all controlled equipage. The NavSup 306 is normally used aboard ship, and its use is described in this chapter. However, the NavSup 460 may be used and its preparation and use is comparable to the NavSup 306.

The NavSup 306, properly prepared and with representative entries, is illustrated in figure 7-11. The form is prepared in duplicate. The supply officer retains the original and the copy is furnished to the custodial department. While preparation of the form is a supply responsibility, the following guidelines may be helpful in understanding the purpose and use of the form.

1. Items requiring custody signature are identified on the NavSup 306.
2. The responsible department is identified on each card. When responsibility for individual pieces of equipment listed on one line of the allowance list is assigned to two or more departments, separate cards are prepared for each department showing the numerical allowance for which the department is responsible.
3. Cards are numbered consecutively for each department.
4. The numerical allowance for each item as shown by the allowance list is indicated on each card. When responsibility is divided, the total of all cards must equal the total allowance.
5. The FSN, unit of issue, and unit price is shown if it can be determined.
6. The allowance authority must be shown.
7. The complete description of the item must be shown, including serial numbers if the item is so identified.

The department copy of the NavSup 306 should be kept current by posting all equipment receipts and expenditures as they occur. As transactions are posted to the original NavSup 306 by supply personnel, each new balance must be attested by the signature of the head of department for signature required items.

The custody records within the department are optional, but the copy of the NavSup 306 provides a ready-made system with the division officer or petty officer who has physical control



EQUIPAGE STOCK CARD AND CUSTODY RECORD
NAV. S. AND A. FORM 306 (REV. [illegible])

CUSTODY SIGNATURE REQUIRED ☒ YES ☐ NO
CARD NO. OP 2

DEPARTMENT OPERATIONS
ALLOWANCE 8
STOCK NO. 1H6650-254-8969
UNIT EA
UNIT PRICE $165.
ALLOWANCE LIST NO. 2-240034001
GROUP PAGE LINE

BINOCULARS, mag., 7 x 50 with filters, case, and strap
Serial numbers on attached list

DATE	VOUCHER NO.	RECEIVED FROM ISSUED TO	QUANTITY RECEIVED	QUANTITY ISSUED	BALANCE	I acknowledge receipt of quantity of this article as indicated
4/25/6-	81160196	NSD Newport	2		8	B. J. Keller, Lt.
6/1/6-	Survey 81530243	NSC Nor. Va.		3	5	B. J. Keller, Lt.
6/10/6-	81620258	NSC Nor. Va.	3.		8	B. J. Keller, Lt.
8/4/6-	Inventory-Relief-Head of Department				8	L. Wood, LTJG

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7.3

Figure 7-11.—Equipage stock Card and Custody Record, NavSup 306.

of the item signing the card. Memorandum receipts may be obtained when the above personnel are required to issue controlled equipage to others on a temporary basis.

INVENTORY OF CONTROLLED EQUIPAGE

All items of controlled equipage must be inventoried annually during the month of March and:

1. When the ship is commissioned, inactivated, or reactivated.
2. Upon relief of the head of department for those items in the department concerned.
3. Upon change of command at the discretion of the relieving commanding officer.

A special inventory of controlled equipage taken for one of the above reasons satisfies the requirement for an annual inventory.

Each head of department is responsible for conducting the inventory of those items for which he has custody. The file of duplicate NavSup 306s provides a logical basis for conducting the inventory which must be completed within 30 days after commencement. Each item must be sighted and inspected for serviceability by the inventorying officer. Items identified by serial numbers must be checked against the serial numbers recorded on the custody cards. As each item is inventoried, the inventorying officer enters the date, quantity, and his signature on the reverse of the custody card, and as the inventory progresses or immediately after completion, this inventory record is transcribed to the original NavSup 306 held by the supply officer.

Any shortages or items found to be unserviceable must be covered by a survey request. The inspection and resulting survey of unserviceable equipage must be emphasized since, upon completion of the inventory, the supply officer prepares a list of controlled equipage deficiencies which is submitted to the type commander. Funding for procurement of replacement controlled equipage is based on this deficiency list.

Upon relief of the engineer officer, the inventory of controlled equipage should be conducted jointly and completed prior to detachment of the officer being relieved. If this is not possible, the relieving officer must complete the inventory as soon as practicable after assuming his duties. The relieving letter should contain a statement that the joint inventory of controlled equipage was taken, that surveys have been prepared for shortages and unserviceable items, and that requests have been submitted for replacement of these items. A copy of the letter should be furnished to the supply officer.

During inventory, any items of controlled equipage excess to the needs of your department and in excess of allowance should be reported to the supply officer. The items may be transferred to other departments if needed or reported to the type commander for disposition.

EXPENDITURE OF MATERIAL

Material is expended when it is issued from supply storerooms, when it is transferred to another ship or station, or when it is surveyed. Issues have already been discussed so the remaining two types of expenditures, transfers and surveys, are presented here.

TRANSFERS

No stores or other Government material may be transferred from a naval ship without the approval of the commanding officer. The supply officer may be given authority to approve transfers, and, within this authority, no material may be transferred without the knowledge and approval of the supply officer since he is responsible for ensuring that no transfers are made that are contrary to the best interests of the ship or to the policy of the commanding officer. The engineer officer must decide when material (equipment, equipage, or supplies) is excess to the needs of his department and report it to the supply officer. The supply officer will normally seek the advice of the engineer officer before transferring from supply storerooms any material that is used in engineering spaces.

The supply officer is responsible for preparation of transfer documents and compliance with transfer procedures contained in current instructions.

One of the more common types of transfer involves emergency requirements for repair parts while deployed. When another ship's requirement can be supplied, the decision to transfer must be based on past usage, essentiality of the equipment it supports, time required to obtain replacement, and judgment of the engineer and supply officers. If possible, the transfer should be made, since it permits another ship to get its equipment back into operating condition in the least amount of time. Another practical reason for making the transfer is that there will be times when the shoe is on the other foot, and if a ship has the reputation of transferring repair parts to other ships in need, the chances of an urgent request for a repair part being answered are much greater.

SURVEYS

A survey is the procedure required by Navy Regulations when naval property must be:

1. Condemned as a result of damage, obsolescence, or deterioration.
2. Appraised as a result of loss of utility.
3. Acknowledged as nonexistent as a result of loss or theft, necessitating the expenditure of the accountable material from the records of the holding activity.

The completed survey report provides a record of:

1. The administrative review of the condition of material, the cause of the condition, the responsibility therefore, and the recommendation for disposition.
2. The authorization to expend the material from the records on which carried.

Types of Surveys

There are two types of surveys; formal and informal. The type to use for a specifc survey action is determined by the material involved and the circumstances that made the survey necessary.

Formal Survey.—A formal survey is made by a commissioned officer or a board of three officers (one of which must be a commissioned officer). The commanding officer appoints the officer or board. The following officers may not serve as survey officer or on the survey board:

1. Commanding officer.
2. The officer on whose records the material being surveyed is carried.
3. The officer charged with the custody of the material being surveyed.

A formal survey is required for certain types of material so designated by the bureau, command, or office concerned and is covered by specific instructions in NavSup Manual. Formal survey is also required at all times when it appears that the responsibility for loss or damage may be placed on a person or persons in the naval service. When the type of survey is not specified in instructions from higher authority, the commanding officer determines whether a formal or informal survey is required.

Informal Survey.—Informal surveys are made by the head of the department having custody of the material to be surveyed. The informal survey is used when survey action must be taken, but formal survey is not required.

Survey Not Required

Formal or informal surveys are not required when material (except fuels, clothing, ship's store stock, equipage requiring custody signature, and labor saving devices with trade-in value such as typewriters) is lost as a result of physical deterioration, damage by handling, fire, water, or other similar circumstances and the value of the loss is less than $100 per item.

Survey Procedure

Generally, the survey procedure is composed of the following steps:

1. Request for survey.
2. Action by the commanding officer on the survey request.
3. Report of survey by surveying officer or board.
4. Action by reviewing authority.
5. Expenditure and disposal action.

Initial Request

Any person in the naval service, who is aware of a material condition that requires a survey, may initiate a request for survey, but requests are normally initiated within the department having custody of the material. The initial survey request is made in rough on a Survey Request, Report and Expenditure (NavSup 154).

The survey request is submitted by the originator, one copy only, to the commanding officer via the engineer officer (except when he is the originator) and the supply officer as directed by local procedures.

Included in the initial survey request must be a statement by the originator relative to:

1. Location of material and name of person or persons to be contacted by surveying board or officer.
2. Description (including nomenclature, FSN, serial, etc.) and condition of material.
3. Cause of loss, damage, deterioration, or obsolescence of material.
4. Responsibility for cause or condition, or a statement that responsibility cannot be determined.
5. Recommended disposition of material and action to be taken in regard to cause and responsibility. Reference should be made to any special survey procedures contained in manuals or instructions issued by higher authority. When controlled equipage is being surveyed, the equipage custody card number should be shown. As the request is forwarded via the engineer officer and supply officer, additional information may be added. The purpose of the initial request is to provide all data available to assist the commanding officer in determining the type of survey, if any, and to assist the members of the survey board or the surveying officer. When completed, the initial survey request is forwarded to the commanding officer.

Action by the Commanding Officer

The commanding officer reviews the initial request, determines the type of survey to be conducted (formal or informal), appoints the surveying officer or survey board, signs the request, and returns it to the person or office designated to prepare smooth survey requests (normally the supply office).

The smooth survey request is then prepared from the initial request and completed down to the "Survey Report and Recommendation" section. The number of copies depends on the distribution requirements set forth in NavSup Manual for the type of material being surveyed. The initial request is usually attached to the smooth request.

The person who submitted the initial request for survey signs the original of the smooth request as the originator, and it is submitted to the commanding officer for his

160

signature and delivery to the appointed surveying officer or senior member of the survey board.

Report of Survey

The surveying officer or survey board makes thorough investigation of the material or the circumstances under which material is missing to determine condition at the time of survey and fixes the cause and responsibility for that condition. If the responsibility cannot be determined or is not applicable (as in the case of material worn out through normal use), this fact is indicated.

The findings and recommendations of the surveying officer or survey board are entered on a copy of the smooth request and returned to the supply office. The "Survey Report and Recommendation" section of the smooth survey request is completed, signed by the surveying officer or survey board, and submitted to the commanding officer for review.

Action by Reviewing Authority

The completed survey request and report is reviewed by the commanding officer or officer ordering the survey if the survey was ordered by higher authority, and his approval or disapproval is indicated. He signs and dates the survey and returns it to the supply office. Upon receipt of the approved smooth survey, the supply officer assigns and expenditure number, takes the indicated expenditure action, and completes and signs the expenditure portion of the survey. A copy of the completed survey is then returned to the originator and a copy to the cognizant head of department if other than the originator.

FINANCIAL CONTROL OF SHIP'S OPTAR

The purpose of this section is to explain briefly how the Navy is funded and the method used to finance the day-to-day operation of ships.

With few exceptions (Shipbuilding, alteration, research and development, etc.), the Navy is funded by annual appropriations which are included in the Defense Appropriations Act passed each year by Congress. The money is made available to the Navy in the form of appropriations which are assigned to the various systems commands and bureaus who are responsible for administering them. The appropriation 17-1804 which is for operations and maintenance of ships is administered by NavShips and distributed through the fleet commanders. The fleet commanders then grant allotments to each type commander under their command to enable them to carry out their missions.

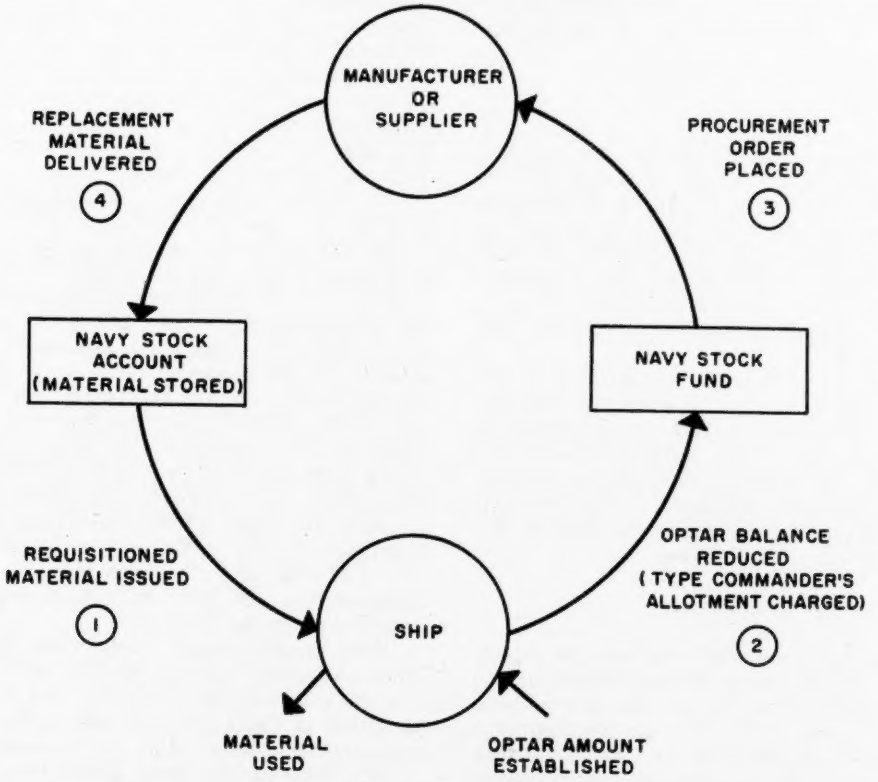
The type commanders grant obligational authority, or operating target (OPTAR), to the ships within their commands for procurement of supplies and equipage. While the type commander performs the accounting required for the allotment, the supply officer of each ship must maintain records in sufficient detail to enable the commanding officer to determine the status and ensure the proper and efficient use of the OPTAR. The amount of the OPTAR grant may be exceeded only with the approval of the type commander. All TYCOMS receiving allotments are authorized to grant OPTARs to ships and units within their command. The budgeting for the initial grant is performed by the TYCOM and the method of requesting augmentation and the justification required are established by the TYCOM.

Two terms, Naval Stock Fund and Naval Stock Account, are frequently used in connection with supply operations and a brief explanation of their purpose will serve to give a better understanding of supply accounting.

The Naval Stock Fund (NSF) is a revolving fund established to finance procurement of material. After procurement, the material is held in an inventory account, Naval Stock Account (NSA). Thus the NSF always remains in balance with the total represented by either money or inventory. The NSA inventory is that material carried at ashore supply activities and on some supply ships. The relationship of the NSF and NSA is shown in figure 7-12.

When a ship submits a requisition and the material is issued, the NSA is reduced. The amount of the issue is charged to the ship's OPTAR and credited to the NSF which may then use the money to procure replacement inventory.

The Appropriations Purchases Account (APA) is another inventory account that is used extensively. APA material has been purchased with appropriated funds and is held in store awaiting issue. It is usually used for items of major equipment, NavShips controlled test equipment, and repair parts of limited or special application. When this material is requisitioned


MANUFACTURER
OR
SUPPLIER
REPLACEMENT
MATERIAL
DELIVERED
④
PROCUREMENT
ORDER
PLACED
③
NAVY STOCK
ACCOUNT
(MATERIAL STORED)
NAVY STOCK
FUND
REQUISITIONED
MATERIAL ISSUED
①
OPTAR BALANCE
REDUCED
(TYPE COMMANDER'S
ALLOTMENT CHARGED)
②
SHIP
MATERIAL
USED
OPTAR AMOUNT
ESTABLISHED

114.17

Figure 7-12.—Relationship of the Navy Stock Fund (NSF) and the Navy Stock Account (NSA).

by the ship, the OPTAR is not reduced since the material has already been charged to "end use." A statistical charge is made for the purpose of accumulating total operating cost within the Navy.

FUND CODES

Under current accounting procedures, operating costs are accumulated according to the purpose or type of expenditure and are identified by fund codes. The type commander designates the fund codes that may be used by each ship and under what circumstances they may be used. Generally, the fund codes used aboard ship identify expenditures for equipage, repair parts, consumables, and services. The OPTAR grant may specify limits for each of these categories. For example:

Equipage*	$2,500
Repair Parts	7,000
Consumables	5,000
Services	500
Total OPTAR	$15,000

*Amount based on controlled equipage deficiency list.

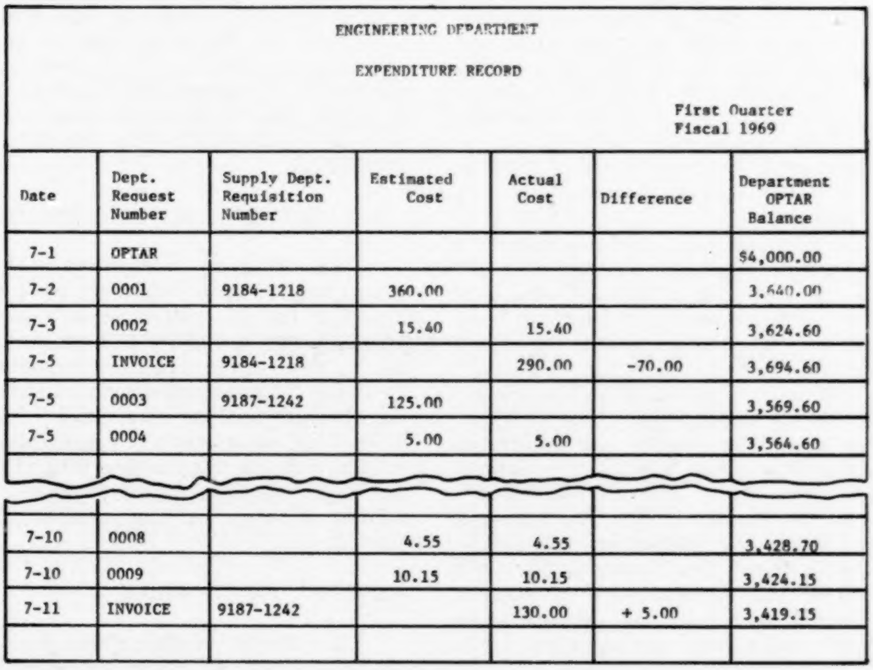
Fund codes must be carefully assigned on the NavSup 1250 (discussed earlier) to prevent incorrect charges to these categories.

DEPARMENTAL BUDGETS

As was stated earlier, the commanding officer is responsible for the proper and efficient utilization of the OPTAR. One way this can be accomplished is by distributing the OPTAR to the various departments in the form of a budget. The use of the budget is optional but it has proved its effectiveness. When departmental budgeting is used, the supply officer maintains budget records in conjunction with the OPTAR records. A weekly report of the OPTAR and budget status is made to the commanding officer with a copy to each department. The red copy of each NavSup 1250, which has been processed by supply and charged to the engineering department budget during the preceding week, is included with the departmental copy of the budget report. This enables the engineer officer to reconcile the department record with supply records.

Departmental budget or expense records are maintained at the option of the engineer officer. Figure 7-13 illustrates one method of maintaining control of department spending.

While the ship's OPTAR and department budgets are not synonymous, they do have a direct bearing on each other. Issues from supply storerooms reduce the budget but do not reduce the OPTAR. DTO requisitions reduce both the budget and the OPTAR. Stock replenishment requisitions submitted by supply reduce the OPTAR but do not reduce the budget. If the budget is exceeded, it means that supply has issued more material from their storerooms than could be replaced. When this happens, the storeroom capability to support the ship's requirements has been reduced. For this reason, it is equally important that neither the budget nor the OPTAR be exceeded.



ENGINEERING DEPARTMENT

EXPENDITURE RECORD

First Quarter
Fiscal 1969

Date	Dept. Request Number	Supply Dept. Requisition Number	Estimated Cost	Actual Cost	Difference	Department OPTAR Balance
7-1	OPTAR					$4,000.00
7-2	0001	9184-1218	360.00			3,640.00
7-3	0002		15.40	15.40		3,624.60
7-5	INVOICE	9184-1218		290.00	-70.00	3,694.60
7-5	0003	9187-1242	125.00			3,569.60
7-5	0004		5.00	5.00		3,564.60
7-10	0008		4.55	4.55		3,428.70
7-10	0009		10.15	10.15		3,424.15
7-11	INVOICE	9187-1242		130.00	+ 5.00	3,419.15

114.16

Figure 7-13.—A sample expenditure record for the engineering department.

163

CHAPTER 8

ENGINEERING STANDARDS

The Chief of Naval Operations establishes the standards of readiness and preparedness for war required of all ships of the U. S. Navy. The type commanders conduct periodic trials and inspections, and take all practicable steps to ensure that ships of the command maintain the required standards of readiness and preparedness. Principally, the standards require that the administration of the ship's organization, the material readiness of the ship, and the state of training of the crew be such that the ship is capable of effectively and efficiently performing her mission.

As an incentive to gain greater efficiency through competition, type commanders annually (normally) present Battle Efficiency awards to ships of the command based on merit attained in the readiness inspections, competitive exercises, and day-to-day operations. The Battle Efficiency awards are presented in accordance with OpNav Instruction 3590.4. The Chief of Naval Operations may authorize additional awards for type commands and he may suspend awards during periods of national emergency. Each type commander designates the required trials, inspections, and exercises, and establishes minimum requirements for ships of the command. The type commander's directives should be consulted for information concerning the Battle Efficiency requirements for a particular ship.

Engineering readiness (including damage control) plays a major role in the battle efficiency of any ship. Provided that consideration is given to all factors affecting them (rather than just quantitative comparison) the following are the principal components of engineering readiness:

1. Reliability
2. Fuel performance
3. Feed and fresh water performance
4. Trial performances
5. Ability to control damage and engineering casualties.

This chapter provides detailed information concerning (1) good engineering practices (those recommended as well as the ones that are mandatory to the attainment of required engineering standards), (2) engineering trials and readiness inspections scheduled by the type commanders, and (3) material inspections and ship surveys conducted by the Board of Inspection and Survey.

GOOD ENGINEERING PRACTICES

When followed scrupulously by operating personnel, certain rules of good engineering practice can be relied on to contribute substantially to the safe and economical operation of naval engineering plants while materially reducing the personal effort required to maintain an efficient and reliable plant. The engineer officer is responsible for enforcing the rules of good engineering practice within the engineering department and for keeping the commanding officer informed of malpractices beyond his control.

GENERAL PROCEDURES

The steam engineering plant should be operated with no more variation in speeds, pressures, and temperatures than is consistent with operational commitments of the ship, and with these factors always maintained as near their minimum designed values as possible for the power required.

A variation in the output of a single component of the engineering plant can upset the steam cycle balance and require compensatory adjustments on stations throughout the plant thereby resulting in additional work for the personnel of the watch and uneconomical

164

operation in general. This fact is often amply illustrated by a comparison of fuel consumption scores attained during economy trials with those logged during normal routine operations underway. The development of teamwork among watch personnel and the promotion of a spirit of competition between watches can do much to promote fuel economy and improve overall plant performance and reliability.

The engineer officer should exert every effort to ensure that prescribed acceleration tables are observed. In modern engineering plants, important components may be seriously overloaded when excessive acceleration rates are used. Built-in safety factors will protect the components if rapid acceleration is restricted to emergencies, but routine abuse of acceleration tables will seriously reduce the reliability of the plant. Observance of prescribed acceleration tables not only extends machinery life and conserves fuel but provides a time standard by which the engineroom and fireroom watches, and the OOD can develop into a smoothly functioning team with each knowing what to expect of the other. The ship's training program for qualification of officers of the deck underway should familiarize the future officer of the deck with good engineering practices.

Combatant ships operate frequently at speeds considerably below maximum and require, at cruising speeds, only a fraction of the power that the main turbines are designed to provide. The engineer officer should determine the most economical engine and boiler combination that can be used for any operating condition that might arise. In determining the most economical combination, the type commander's directives must be observed and allowances must be made for operating contingencies that may often override considerations of economy.

The engineer officer should require that accurate records of boiler feed water and potable water consumption be maintained. The ship's normal consumption must be determined and posted in tabular form at main engine control as a ready reference. Any unexplained or marked increase over the normal is a sure sign of a leak or faulty operation of the engineering plant and either possibility could cause serious trouble. A leak, no matter how small, must always be considered a source of inefficiency. Feed water losses can usually be avoided if the engineer officer:

1. Requires that watch personnel maintain a close watch on pump shaft glands, valve glands, drain collecting tanks, atmospheric exhausts, and all other possible sources of leakage.
2. Drills the engineering crew in the proper procedures for transferring condensate.
3. Requires that operating personnel always consult the watch in the spaces concerned prior to taking on make-up feed, running water down from deaerating feed tanks, and shifting feed water suctions.

For reliable and efficient operation, boilers must be kept clean, both inside and out. The personal attention and interest of the engineer officer is one of the most effective means of maintaining reliable and clean boilers. He may delegate preliminary boiler inspections to qualified subordinates but the final inspection after any boiler work must be made by the engineer officer. Soot and scale are efficient insulators that prevent optimum heat transfer and make necessary a progressively increasing combustion rate in order to maintain a steady steaming rate. Clean boilers will result if the following instructions are carried out:

1. Inspect and clean boiler firesides every 600 hours of steaming or more often, if conditions warrant. Inspect and clean watersides between 1800 and 2000 hours of steaming or more often, if conditions warrant.
2. Blow tubes at least once each watch underway and twice a day in port. (Permission of the OOD must be obtained before blowing tubes).
3. Blow down boilers as often as necessary to maintain the specified water analysis and avoid high concentrations of scale-forming salts. (Give steaming boilers a surface blow at least daily.)
4. Use the emergency feed pump if available aboard ship, to recirculate the water when adding boiler compound to an idle boiler. This practice ensures equal distribution of alkalinity throughout the watersides of the boiler.
5. After securing a steaming boiler and allowing sufficient time for reducing circulation due to generation, give the boiler a good bottom blow to remove suspended impurities and scale-forming salts.
6. Take all possible measures to prevent oil contamination of the feed system and boilers. It is imperative that all engineering operating personnel be made aware of the seriousness of oil contamination of boiler water, its possible causes, and the consequences which can result.

Boilers should be steamed with a very light brown haze whenever permissible. Dirty atomizers, contaminated fuel, and fuel of the improper temperature may require excess air in order to maintain acceptable stack conditions; therefore, the condition of the fire (yellow-orange or golden yellow in shade) as well as stack conditions must be observed in order to determine the true state of combustion efficiency. Considerable care is required to prevent leakage of air into a boiler. Air that enters a boiler at any place other than through a burning register does not contribute to furnace combustion and may materially affect combustion efficiency.

Chloride contamination of the water in the boiler feed and condensate systems is an ever-present threat to the material integrity and operational readiness of the ship's engineering plant. All means provided for the determination of the chloride content of boiler water must be maintained in good working order, and operating personnel must be frequently drilled in the importance and methods of the prevention of chloride contamination through the determination and control of the chloride content of the water in the boiler feed and condensate systems. Operating personnel must be alerted to ensure that the deaerating feed tank is functioning properly to remove dissolved gases from the boiler feed water. Dissolved oxygen tests must be conducted daily on water to steaming boilers.

Inattention to feed water treatment with the resultant failure of boiler tubes is the greatest single cause of boiler casualties. The engineer officer should ensure that his oil king and the engineering watch supervisors in the fireroom are graduates of the Boiler Feedwater Test and Treatment Course and are certified to perform the feed water tests and treatments that are prescribed by the Naval Ship Systems Command and the manufacturer for the installed boilers. He should never assume his subordinates are competent, but should ascertain their ability through personal observation of their performance.

Proper temperature of the lubricating oil in the engineering plant must be maintained at all times to prevent bearing wear. The engineer officer must insist that operating personnel be alert for signs of overheated bearings, foaming or emulsified oil, the presence of bearing metal and other foreign particles in lubricating oil strainers, oil leaks, low oil level in lubricating oil sumps, and the presence of rust on journals and gearing.

The overall loss of efficiency in an improperly operated condenser and its component auxiliaries can be considerable. The use of more cooling water than is necessary to maintain the desired vacuum on condensers can result in pumping overboard a large amount of heat (from the condensate system) that will have to be replenished by the boilers. Excessive recirculation of the condensate will have a similar result. Air leaks in the condenser or its components may overload the air ejectors and lower the vacuum. Fluctuation in or excess steam pressure to the air ejectors is very uneconomical. The operation of steam driven auxiliary pumps at speeds in excess of requirements also wastes steam.

Ventilation motors in fresh air supply systems throughout the ship should be operated at slow speed at all times when weather conditions are such as to require the use of steam for heating the air. The steam to preheaters and reheaters should be secured before operating blower motors on high speed and blower motors should never be operated at a faster speed than is necessary to attain a comfortable temperature in the compartments served. Circulation of fresh air in a compartment can generally be facilitated by operating the exhaust blower on fast speed and the supply blower on slow speed.

Cleanliness of engineering spaces, equipment, and machinery is one of the most important of the good engineering practices. Machinery must be kept free of oil and dirt so that lubricating oil and fuel oil leaks can be quickly observed and proper and timely action can be taken to prevent casualties. Trash and spilled oil in engineering spaces are personnel hazards as well as fire hazards. All water, steam, lubricating oil, and fuel oil leaks must be promptly corrected in order to promote cleanliness in engineering spaces. Clean spaces, equipment, and machinery denote that the crew takes pride in their work and their ship.

An important safety precaution which the engineer officer must make certain is always observed by engineering personnel is that the practice of hosing down spaces above the level of the bilge deck plates is PROHIBITED. Extreme care in the handling of charged hoses and constant vigilance during the cleaning of bilges is necessary to prevent damage to personnel and equipment.

Information concerning performance data and operating limits of the equipment and machinery of a ship's engineering plant is published in the Naval Ships Technical Manual, manufacturers technical manuals, and the Ship

Information Book (in older ships, the General Information Book, the Piping System Instruction Book, the Record of Electrical Installations and Electrically Operated Auxiliaries With Performance Data, and General Description of Electronics System Installation).

SAFETY PRECAUTIONS AND OPERATING INSTRUCTIONS

General safety precautions should be known and observed by all personnel. Safety precautions for particular duties or operations must be known and observed by all personnel who perform such duties or operations. The engineer officer is responsible for ensuring:

1. That all prescribed safety precautions are strictly observed by all persons within the department and by others who may be concerned with matters under his control.
2. That all applicable safety precautions are kept properly posted, in conspicuous and accessible places.
3. That the personnel concerned are drilled in procedures for the observance of safety precautions.

Each division officer is responsible for:

1. Carefully instructing his subordinates in all applicable safety precautions.
2. Requiring that his subordinates strictly observe all applicable safety precautions.

Having knowledge of safety precautions does not necessarily ensure that the personnel concerned will observe them. Danger to personnel exists to some degree in every shipboard engineering operation. Because danger is a constant companion, some engineering personnel tend to discount its disastrous possibilities and are often prone to ignore the measures necessary to prevent the occurrence of accidents, hence, they must constantly be reminded of the possibility of such occurrences.

One method, devised to remind equipment operators of the hazards to personnel (as well as to equipment) attending the operation of certain equipment, is to permanently post safety precautions in conspicuous places nearby or on the equipment to which they apply. In addition, personnel performing work in which definite hazard(s) to their safety is known to exist should be reminded of the hazard(s) by the conspicuous posting of applicable safety precautions in the area of the ship where such operations are normally performed.

Each member of the engineering department should be familiar with the following basic precepts of safety:

1. REPORT UNSAFE CONDITIONS. Each individual concerned must report to his superiors any unsafe condition or any equipment or material which he considers unsafe.
2. WARN OTHERS. Each individual concerned must warn others whom he believes to be endangered by known hazards or by failure to observe safety precautions.
3. USE PROTECTIVE EQUIPMENT. Each individual concerned must wear or use protective clothing or equipment of the type approved for the safe performance of his work or duty.
4. REPORT INJURY or ILL HEALTH. All personnel must report to their supervisors any injury or evidence of impaired health occurring in the course of work or duty.
5. EXERCISE CAUTION. In the event of an unforeseen hazardous occurrence (emergency condition) each individual is expected to exercise such reasonable caution as is appropriate to the situation.

In the shipboard engineering department, the lack of personal knowledge of safety precautions, the absence of conspicuously posted safety precautions, or the failure to observe known applicable safety precautions often results in temporary or permanent personnel disablement, and, too frequently, results in loss of a life. Emphasis on safety precautions must be part of the daily supervision of duties by division officers and petty officers. Supervision of personnel in matters involving safety precautions is particularly necessary in the formative stages of training, when proper habits and reflexes are being established.

Inspections of personnel and equipment should be made periodically to ensure that personnel are observing safety precautions and that the equipment in use is in safe operating condition. All safety devices and attachments on machinery and equipment should be checked for proper operation periodically (usually, weekly). Any safety device found to be inoperative must be immediately repaired or, if immediate repair is not possible, a prominent warning of conditions must be displayed constantly.

All engineering department personnel must be made aware of the risks to equipment as well as personnel involved in purposely disabling a safety device (safety valve, circuit breaker, pressure and/or temperature alarm). Personnel who are observed to be violating safety precautions must be immediately corrected. Each violation must be handled separately, with consideration for the seriousness of the violation.

Where personnel of the engineering department are required to operate equipment or perform evaluations under the control of another head of department, the responsibility for teaching and enforcing the safety precautions relating to the operations rests with the head of department controlling the operation. For example, weapons and ammunition handling requires special instructions by the weapons officer.

Engineering machinery and equipments require protection against improper, careless, and abusive operation. One safeguard against improper operation is, of course, properly trained operators. In an emergency, however, a properly trained operator may not be available, and it may be necessary to utilize an operator who is unfamiliar with the proper operating procedures for an item of machinery. To provide instructions for operators who are unfamiliar with the equipment and to re-emphasize proper operating procedures for the experienced operator, operating instructions must be permanently and conspicuously posted nearby or on the equipment to which they apply.

Manufacturers' technical manuals contain operating instructions and precautions pertaining to the shipboard machinery and equipments furnished by them. The Naval Ships Technical Manual contains operating instructions and precautions pertaining to classes of shipboard machinery and equipment installations. The data and instructions in the Naval Ships Technical Manual are in accordance with what is considered the best engineering practice for the operation, testing, and safety of shipboard machinery and equipment installations, and for the safety of the personnel concerned.

The Naval Ship Systems Command is responsible for initially furnishing newly constructed ships and conversions with standard and nonstandard operating instructions and safety precautions (in form suitable for posting) for material under the technical control of NavShips. For ships in commission and in service, plastic laminated standard and nonstandard operating instructions and safety precautions are available in accordance with instructions in the Navy Stock List of Forms and Publications, NavSup 2002.

The engineer officer is responsible for the adequacy, accuracy, and proper posting of the necessary operating instructions and safety precautions in spaces under his cognizance. When unforeseen conditions arise or when the engineer officer considers that the operating instructions and safety precautions furnished are inadequate, he must so inform his commanding officer who will issue such additional instructions or precautions as deemed necessary and advise the Naval Ship Systems Command (via appropriate administrative and operational commanders) of the premises.

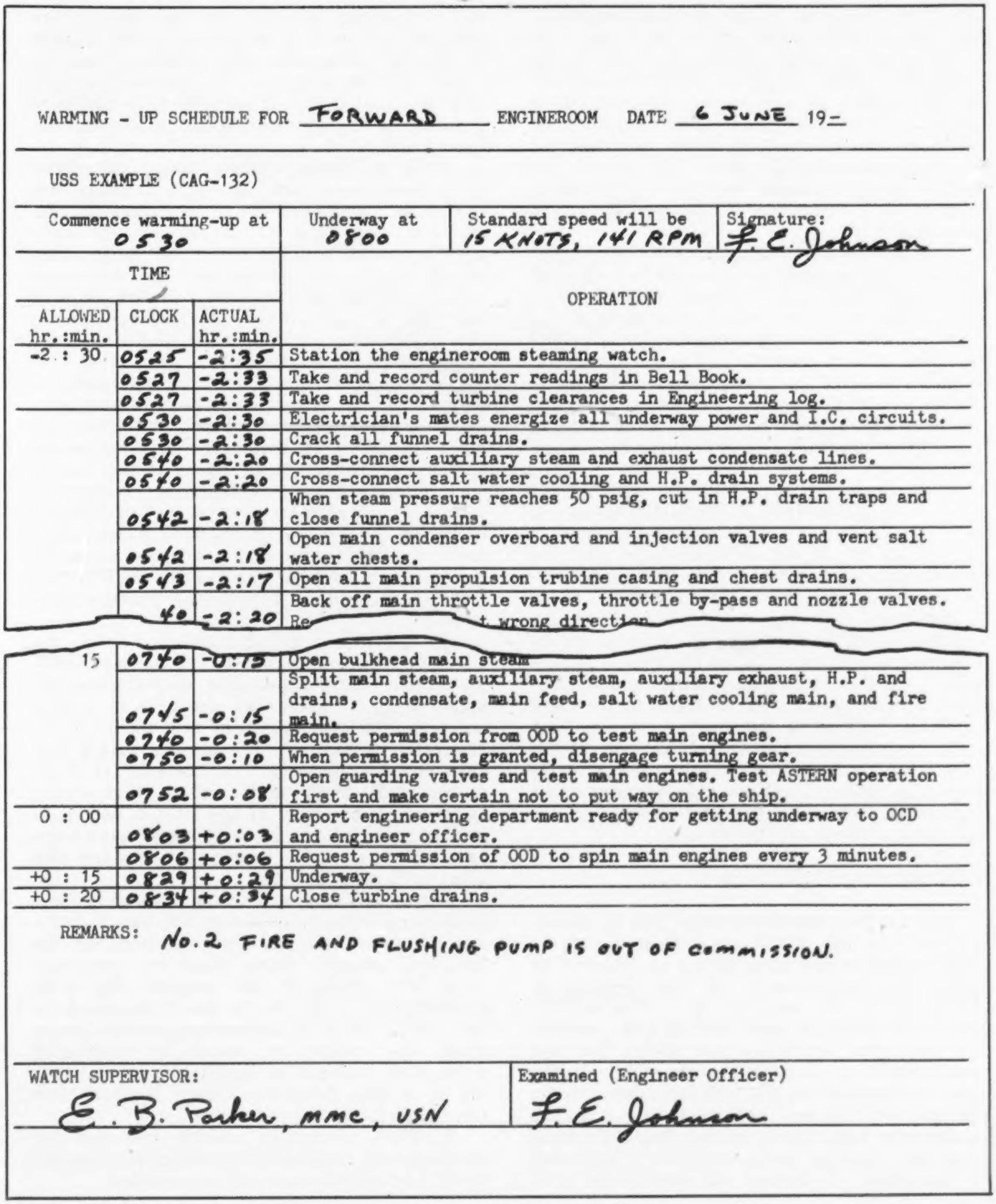
WARMING-UP SCHEDULES

Warming-up schedules for propulsion machinery and boilers are chronological checklists of the key steps for lighting boiler fires and warming up the ship's main engineering plant in preparation for getting the ship underway in accordance with the general degree of readiness in effect. The format for each warming-up schedule is prescribed by the type commander for ships of the type. A sample engineroom warming-up schedule is shown in figure 8-1. The scheduled times relative to the time of reporting ready are printed on the form and the corresponding clock and actual times are entered by the watch supervisor. On the format in figure 8-1, the column titled ALLOWED indicates the time (relative to reporting ready) scheduled for the accomplishment of each operation. The column titled CLOCK is for recording the time (according to the clock) when the operation was accomplished. The column titled ACTUAL is for recording the time relative to reporting ready when the operation was actually accomplished.

The use of warming-up schedules ensures that the important task of readying the ship's engineering plant for operation is carried out according to a proven schedule designed to minimize confusion, establish orderly procedures, and provide assurance that the steps necessary to the operation of the plant are performed in the proper sequence. The warming-up schedules should be used without regard to the relative state of experience of the personnel involved. Completed warming-up schedules are examined by the engineer officer and disposed of in accordance with current instructions of the appropriate type commander.

SECURING SCHEDULES

Securing schedules for propulsion machinery and boilers are chronological checklists of key



WARMING - UP SCHEDULE FOR FORWARD ENGINEROOM DATE 6 JUNE 19-

USS EXAMPLE (CAG-132)

Commence warming-up at 0530	Underway at 0800	Standard speed will be 15 KNOTS, 141 RPM	Signature: F. E. Johnson

TIME			OPERATION
ALLOWED hr.:min.	CLOCK	ACTUAL hr.:min.	
-2 : 30	0525	-2:35	Station the engineroom steaming watch.
	0527	-2:33	Take and record counter readings in Bell Book.
	0527	-2:33	Take and record turbine clearances in Engineering log.
	0530	-2:30	Electrician's mates energize all underway power and I.C. circuits.
	0530	-2:30	Crack all funnel drains.
	0540	-2:20	Cross-connect auxiliary steam and exhaust condensate lines.
	0540	-2:20	Cross-connect salt water cooling and H.P. drain systems.
	0542	-2:18	When steam pressure reaches 50 psig, cut in H.P. drain traps and close funnel drains.
	0542	-2:18	Open main condenser overboard and injection valves and vent salt water chests.
	0543	-2:17	Open all main propulsion trubine casing and chest drains.
	40	-2:20	Back off main throttle valves, throttle by-pass and nozzle valves. Re t wrong direction
15	0740	-0:15	Open bulkhead main steam
	0745	-0:15	Split main steam, auxiliary steam, auxiliary exhaust, H.P. and drains, condensate, main feed, salt water cooling main, and fire main.
	0740	-0:20	Request permission from OOD to test main engines.
	0750	-0:10	When permission is granted, disengage turning gear.
	0752	-0:08	Open guarding valves and test main engines. Test ASTERN operation first and make certain not to put way on the ship.
0 : 00	0803	+0:03	Report engineering department ready for getting underway to OCD and engineer officer.
	0806	+0:06	Request permission of OOD to spin main engines every 3 minutes.
+0 : 15	0829	+0:29	Underway.
+0 : 20	0834	+0:34	Close turbine drains.

REMARKS: NO. 2 FIRE AND FLUSHING PUMP IS OUT OF COMMISSION.

WATCH SUPERVISOR: E. B. Parker, MMC, USN	Examined (Engineer Officer) F. E. Johnson

114.19

Figure 8-1.—A sample warming-up schedule for an engineroom.

steps for securing the ship's main engineering plant in accordance with the general degree of readiness in effect. Scheduled times of the respective steps may be relative to receipt of the orders to secure the engineroom or boiler. The securing schedules should list the auxiliary machinery to be used after securing the main engineering plant. The format for each securing schedule must be in accordance with current directives of the appropriate type commanders.

The use of securing schedules ensures that the engineering plant is properly secured and overcomes the normal tendency of the personnel of the watch to secure machinery at too rapid a rate. Securing schedules, too, should be used without regard to the relative state of experience of the personnel involved. Completed securing schedules are examined by the engineer officer and disposed of in accordance with current instructions of the appropriate type commander.

PERFORMANCE STANDARDS

The Chief of Naval Operations and the type commanders require that certain engineering trials and inspections be conducted in order to determine that required standards are being maintained and to accurately evaluate the operational readiness of ships of the type. The frequency of the engineering trials and inspections for readiness is determined by the Chief of Naval Operations and the type commanders.

Engineering readiness trials include the full power trial and the fuel economy trial. Readiness inspections include the administrative inspection, the material inspection, and the operational readiness inspection.

ENGINEERING READINESS TRIALS

Engineering readiness trials (the full power and fuel economy trials) are conducted periodically by the commanding officer as required by CNO and prescribed in Ship Exercises, FXP3 (Revised), and the type commander's directives which indicate specific requirements for conducting exercises and trials. The type commander, a commander subordinate to the type commander, or the task force commander (as appropriate) may assign observers for the engineering trials from another ship of the same type command whenever practicable. When a ship is scheduled to conduct an engineering trial while steaming independently or under other conditions where it is considered impracticable to provide observers from another ship, the trials may be observed by personnel of the ship conducting the trial, subject to the type commander's requirements for self observation of trials.

Prior to commencement of the full power trial, inspections and tests of machinery and equipment should be made to ensure that no material item will interfere with the successful operation of the ship at full power. The extent of the inspections and the tests will largely depend upon the recent performance of the ship at high speeds, the material condition of the ship, and the time limits imposed by operational commitments.

The inspection and tests of reactors, boilers, main engines, pumps, auxiliary machinery, safety devices, piping systems, and all equipment necessary for the proper operation of the engineering plant should be made in accordance with the Planned Maintenance Subsystem which is the primary source that prescribes tests and inspections for machinery and equipment, and in manufacturer's technical manuals, or, in the absence of specific instructions, as the dictates of good engineering practice may require.

Not later than one day before a trial, the engineer officer should report to the commanding officer the condition of the main engineering plant, stating whether or not it is in proper condition and fit to proceed with the trial, or wherein any part, in his opinion, is not in a safe and proper condition. The trial must be postponed if, in the opinion of the commanding officer, the condition of any part of the main engineering plant is such that it might be damaged or disabled, or might cause a personnel casualty if the trial is undertaken.

During all full power trials, and during other machinery trials to which they may be applicable and consistent with the conditions imposed, the following general rules must be observed:

1. The speed of the engines should be gradually increased to the speed specified for the trial. Prior to commencing a full power trial, the machinery should be thoroughly warmed up; this can be accomplished by operating at a high fractional power for sufficient time to stabilize temperatures.

2. The machinery should be operated economically, and designed pressures, temperatures, and speeds must not be exceeded.

3. A trial involving high speeds should not be conducted in shallow water because it is conducive to excessive vibration, loss of speed, and overloading of the propulsion plant. Detailed information on the proper depth of water for a specific ship may be obtained from NavShips Technical Manual.

4. If it is desirable to continue a full power trial beyond the duration originally specified, the observations should be continued until the trial is finished. The trial should be conducted on a continuous basis without interruption. If a trial at constant rpm is discontinued for any reason, the trial should be considered unsatisfactory and a new start should be made. No major changes of the plant set-up or arrangement are allowed during economy trials.

5. During full power or economy trials, all necessary data should be recorded often enough to obtain a reasonably correct indication of the power developed for the period of the trial. The average power developed by diesel-electric plants may be computed from the kilowatt output of each propulsion generator set. Observations must be taken at intervals not greater than one-half hour and at least three observations must be made regardless of the duration of the trial. In ships equipped with torsionmeters, at least 10 torsionmeter observations must be taken at half-hour intervals.

Trial requirements for each ship, covering engine speed for full power at various displacements and injection temperatures, are furnished to commanders and units concerned, by the Deputy Chief of Naval Operations for Fleet Operations and Readiness. The shaft rpm corresponding to 15, 20, and 25 knots is also furnished for the appropriate ships.

Full power trials for competitive purposes are of 4 hours duration, as far as the report data are concerned. The usual procedure is to operate the ship at full power for a sufficient length of time until all readings are constant, before starting the official 4-hour trial period. Economy trials are of 6 hours duration and a different speed is used each time a trial is conducted.

Trials once scheduled should be conducted unless prevented by such circumstances as:

1. Weather conditions which might cause damage to the ship.

2. Material trouble which forces the ship to discontinue the trial, or which might cause damage to the machinery or personnel if the trial were continued.

3. Any situation in which conducting or completing the trial would endanger human life.

If a trial performance is unsatisfactory, the ship concerned will normally be required to hold another trial such as the type commander may consider appropriate to demonstrate satisfactory engineering readiness.

The fact that a ship failed to make the required rpm for any hour during the trial and the amount by which it failed should be noted in the trial report.

The number of personnel assigned to observe engineering trials will vary according to the trial and the size and type of ship being observed. The duties of the observing party are usually as follows:

1. The chief observer will organize, instruct, and station the observing party. He checks the ship's draft, either at the beginning of the trial or before leaving port; supervises the performance of the engineroom observers; checks the taking of counter readings; renders all decisions in accordance with current directives; and checks and signs the trial report.

2. The assistant chief observer assists the chief observer as directed; supervises the performance of the fireroom observers; checks the taking of fuel oil soundings and meter readings; and makes out the trial report.

3. Assistant observers take fuel soundings and meter readings, counter readings, the ship's draft, and other data as may be required for the trial report.

The following items should be accomplished or considered before starting the trial:

1. When requested by the observing party, the ship being observed provides or designates a suitable signaling system so that fuel soundings and the readings of counters and meters may be taken simultaneously.

2. The ship being observed will furnish the chief observer with a written statement of the date of last undocking, and the authorized and actual settings of all main machinery speed limiting devices and the status of safety device tests and inspections. The ship must have its draft, trim, and loading conform to trial requirements. In case a minimum draft is not specified, the liquid loading should equal at least 75 percent of the full load capacity.

3. The chief observer determines draft and trim before and after the trial. He verifies the amount of fuel on board and corrects the amount to the time of commencing the trial.

He determines the full-power rpm required for the displacement and injection temperature existing at the start of the trial.

4. The observing party must be instructed to detect and promptly correct any errors in the recording of trial data since it is important that the required data be correct within the limits of accuracy of the shipboard instruments.

5. The chief observer should instruct members of the observing party to report any violation of trial instructions, of instructions in NavShips Technical Manual, or of good engineering practice. The chief observer should verify any such report and then inform the commanding officer of the ship being observed. He must also include in the trial report a detailed account of any violation.

Some of the requirements pertaining to the manner of conducting full power and economy trials are as follows:

1. Unless otherwise ordered, a full power trial may be started at any time on the date set.
2. The trial should be divided into hourly intervals, but readings should be taken and recorded at least every half hour. Data are submitted as hourly readings in the trial report.
3. Fuel expenditures for each hourly interval of the trial should be determined by the most accurate means practicable, normally by meter readings corrected for meter error and verified by soundings.
4. The appropriate material condition of the ship should be maintained during the different trials.
5. During all engineering trials, normal ship's services must be provided.
6. All clocks in the engineering spaces and on the bridge must be checked and synchronized before commencing the trial.

It is common procedure of many commanding officers, when conducting full power trials, to bring the ship up to a speed several knots below the trial speed of the ship, and then transfer control of the ship's speed (except in an emergency) to the engineer officer until the specified speed is attained. The control engineroom, under the supervision of the engineer officer, brings the speed up slowly, depending upon the conditions of the plant, until the specified speed has been reached. The commanding officer instructs the OOD or navigator to avoid the use of excessive rudder and does not change the ship's course unless conditions warrant.

In most ships with oil-fired boilers the designed boiler power is the first factor that establishes the maximum speed that the ship can attain, and for this reason, it is necessary to check boiler steaming conditions before ordering additional turns. The boilers should not be loaded faster than they are capable of taking care of the increased load. The steam pressure and temperature should be maintained at full value for the appropriate steaming condition. The boilers should be the controlling factor and must be kept ahead of the turbines. If the turbines are allowed to get ahead of the boilers, the main steam pressure and temperature will drop below normal values for that particular steaming condition, or speed of the ship. Then, in order to make up this loss in steam pressure and temperature and to meet additional increases of speed that may be necessary, the boilers must be fired at an extremely high rate. In some ships, the necessary firing rate may exceed the full load rating of the boiler and approach the maximum 120 percent overload capacity rating of the boiler. As far as the engineering plant is concerned, the primary purpose of the acceleration table is to prevent the overloading of boilers. The use of the acceleration table is of particular importance when accelerating near full speed and full power.

Standard forms are available for reporting engineering trials and the forms are for issue as indicated in the Navy Stock List of Forms and Publications, NavSup 2002. The Engineering Trial Report, Transmittal Letter, OpNav form 3540-3A, is submitted by the chief observer with each trial report. Instructions for the preparation of engineering trial reports are printed on the back of the transmittal letter form. Additional instructions are contained in NWIP 10-20. Instructions for compiling trial score are provided in FXP 3B. The Engineering Trial Report, OpNav form 3540-3B, is applicable to steam-driven ships with oil-fired boilers. The Engineering Trial Report, OpNav form 3540-3C is applicable to diesel-driven surface ships and submarines. The forms are used for reporting the engineering phase of the ship trials (chapter 12) as well as the engineering trials discussed in this chapter.

READINESS INSPECTIONS

The type commander is assisted in the conduct of Readiness Inspections (Administrative, Material, and Operational Readiness Inspections) of ships of the command by subordinate commanders and personnel of ships of the type being inspected. The type commander, or a designated subordinate, may assign the ship to assist in the conduct of inspections of ships of the command.

The chief inspector (generally the commanding officer of the assisting ship) organizes the inspection board. The organization of the inspection board, in general, conforms to the administrative organization of the ship to be inspected. The inspection board is divided into appropriate parties, each headed by a senior inspector (or observer) with assistants as deemed necessary. When practicable, the engineer officer of the assisting ship heads the engineering inspection party, which usually consists of three groups: machinery (including main propulsion), electrical, and damage control.

Checklists to assist inspectors conducting readiness inspections are generally furnished by the type commander. For convenience, the checklists for the engineering inspection party are usually divided into three separate sections: machinery (main propulsion), electrical, and damage control. Inspection checklists are not necessarily all inclusive and it may happen that the progress of the inspection will disclose additional items to be considered. Inspectors must be alerted to note all facts pertinent to the inspection.

A critique is held following the readiness inspection to inform the ship's officers of conditions noted and to make recommendations for improvement.

The evaluation of readiness inspections is based upon how well the ship's personnel and material conform to the standards necessary to the efficient accomplishment of the ship's mission. The senior inspector (or observer) for each department of the ship recommends a tentative overall grade for the department based on the individual inspector's evaluation of the results of his inspection. A final grade is awarded by the type commander or a designated subordinate in order to obtain uniformity for the type. The grading system is as follows:

Outstanding (95.0 - 100)	No superior in the type to the knowledge of the inspectors.
Excellent (88.0 - 94.9)	Few minor deficiencies. So markedly above the required minimum standards as to be among the few best.
Good (75.0 - 87.9)	Some minor deficiencies but above required minimum standards.
Satisfactory (62.0 - 74.9)	At required minimum. Capable of performing assigned functions.
Unsatisfactory (0.0 - 61.9)	Below required minimum due to a vital or critical deficiency or a cumulation of minor deficiencies.

Administrative Inspection

Administrative inspections are scheduled by the type commander in order to evaluate how efficiently and effectively prescribed administrative procedures are being implemented by ships of the command. Current directives of the type commander should be consulted when preparing for the administrative inspection.

One of the two categories of an administrative inspection is that of the general administration of the ship as a whole. Items of the inspection that will have a direct bearing on the engineering department, and for which the report of inspection indicates a grade, are as follows:

1. Appearance, bearing, and smartness of personnel.
2. Cleanliness, sanitation, smartness, and appearance of the ship as a whole.
3. Adequacy and condition of clothing and equipment of personnel.
4. General knowledge of personnel in regard to the ship's organization, ship's orders, and administrative procedures.
5. Dissemination of all necessary information among the personnel.
6. Indoctrination of newly reported personnel.
7. General educational facilities for individuals.
8. Comfort and conveniences of living spaces, including adequacy of light, heat, ventilation, and fresh water, with due regard for economy.

The administrative inspection of the engineering department is primarily an inspection of the departmental paperwork, which includes numerous publications, bills, files, books, records, and logs. However, the inspection will also include other items such as the cleanliness and preservation of machinery and engineering spaces; training of personnel; assignment of personnel to watches and duties; the proper posting of operating instructions and safety precautions; adequacy of warning signs and guards; the marking and labeling of lines and valves; and the proper maintenance of operating logs.

Material Inspection

The material inspection is conducted in order to evaluate the actual material condition of a ship, including the ability of all equipment, machinery, and fittings to function properly. On the basis of what the inspection discloses, it may be necessary to recommend repairs, alterations, changes, or developments that will ensure the material readiness of the ship. In addition, the material inspection determines if proper procedures have been followed in the care and operation of machinery and equipment.

In brief, the prescribed requirements for material readiness are as follows:

1. Established routines in accordance with the type commander's instructions for the conduct of inspections and tests, schedules for preventive maintenance, and a system which will ensure timely and effective repairs.
2. Adequate material maintenance records, that are kept in accordance with current directives and that will give the history and detailed condition of machinery and equipment.
3. Planned and effective utilization of the ship's facilities for preservation, maintenance, and repair.
4. Correct allocation of necessary work items to the following categories: (a) the ship's force, (b) the tenders and repair ships, and (c) naval shipyard or other shore repair activity.

The scope of the material inspection scheduled by the type commander will be similar to that of the material inspection made by the Board of Inspection and Survey, discussed later in this chapter. The inspection should be thorough and searching, and cover detailed maintenance and repair rather than general appearance. The distinction between administrative inspections and material inspections scheduled by the type commander should be clearly recognized, and there should be as little duplication as possible. An examination of the material maintenance records and reports will be made to obtain data and material history for a proper understanding of the material condition of machinery and equipment.

Operational Readiness Inspection

The Operational Readiness Inspection (ORI) is conducted in order to evaluate the offensive and defensive capabilities of a ship based on the state of training of the crew and the material condition of the ship. The inspection principally tests the battle organization of the ship by observing ship exercises conducted during a battle problem imposed by the chief observer. Additional ship exercises that test the ability of the ship's watch organization to handle the ship under adverse conditions, also are conducted, observed, and evaluated.

A properly conducted battle problem provides an excellent test of the battle organization of a ship. The degree of perfection achieved in any battle problem is a direct reflection of the skill and application of those who prepare it. A great deal depends upon the experience of the observing officers and petty officers.

The shipboard battle problem tests and evaluates the ability of all divisions of the ship to function together as a team in simulated combat operations. Battle problems can be made the most profitable and significant of all peacetime training, since they demonstrate how ready a department is for combat. The degree of realism of this test governs its value: the more nearly it approximates actual battle conditions, the more valuable it is.

There is one element in conducting a battle problem which substantially increases its value as a testing device: the element of surprise. Of course, preparations for carrying out a problem cannot be kept entirely a secret. Before a battle problem is to be conducted, the ship is furnished information such as:

1. Authority for conducting the inspection.
2. Time of boarding by the inspecting party.
3. Time ship is to get underway.
4. Time for setting material readiness condition one.
5. Time of conducting inspection for zero problem time conditions.
6. Zero problem time.
7. End of problem time.
8. Time of critique.

During the battle problem, engineering and damage control telephone circuits should be monitored by one or more observers. A check should be made for proper procedure and circuit discipline, and for handling of information.

An inspection should be made to see that the engineering plant is properly split in accordance with current directives. Any fire hazards such as paint, rags, or oil should be noted. Check for missile hazards such as loose gear, loose floor plates, tool boxes, and repair parts boxes. The condition of firefighting, damage control, and remote control gear should be carefully inspected.

The maximum benefit obtained from conducting a battle problem lies in the determination of existing weaknesses and deficiencies, and the resulting recommendations for improvement in organization and future training. Every effort should be made by observers to note excellence as well as deficiencies; a knowledge of existing excellence by ship's personnel is helpful to morale and indicates those factors that presently, at least, may receive less emphasis in the shipboard training program.

Visual means of indicating simulated casualties during the battle problem will assist personnel in visualizing the damage imposed. Placards, colored bunting, chalk markings, smoke pots, and tags are all devices that the observer can use to indicate damaged equipment and structures, and wounded personnel. Oral disclosures of simulated damage will also aid in visualizing damage. Should the inadequacy of procedure by ship's personnel result in failure to discover a simulated casualty, observers may resort to coaching, but a notation should be made on the observer's report as to the time allowed before coaching and information were furnished. Special precautions should be taken to give the symptoms of the simulated casualty the same degree of realism as those of an actual casualty.

In order to impose casualties, valves may have to be closed, switches opened, or machinery stopped. In each case the observer should inform responsible ship's personnel of the action desired, and the ship's personnel should operate the designated equipment. A casualty exercise should be omitted entirely if there is danger that personnel injury or material damage might result because of lack of preparation or experience of personnel concerned. The supply of lubricating oil to the main engines or the supply of feed water to the boilers must not be stopped to simulate casualties. An emergency procedure must be established by the observing party and ship's crew to take proper action in case actual casualties—as distinguished from simulated casualties—should occur.

The general announcing system (the 1MC circuit) may be used by the ship but observers normally will have priority in its use. The problem time announcer will use the general announcing system to announce the start of the battle problem, the problem time at regular intervals, the conclusion of the problem, and the restoration of casualties. However, the general announcing system is kept available at all times for use in case of actual emergency. All other announcing system circuits and means of interior communications are reserved for the use of the ship.

A critique of the battle problem should be held on board the observed ship before the observers depart, in order that review of the problem and the action taken may be made when both are fresh in the minds of all concerned. The critique is attended by all the ship's officers, appropriate chief and first class petty officers, the chief observers, and all senior observers. The various points of interest of the battle problem are discussed, and the chief observer comments on the overall conduct of the problem after the senior observers have completed their analysis of the battle problem as developed from their observers' reports.

The observers' reports will be in the form prescribed by the type commander, and will include any additional instructions given by the chief observer. The reports of the observers are collected by the senior observer for each department; senior observers submit their reports to the chief observer. All observers' reports are reviewed by the senior observer for each department before the critique is held.

The observers' reports also serve to furnish the ship with detailed observations of the battle problem which may not, because of time limitations, be brought out during the critique. The ship receives a copy of all observers' reports; in this way, each department is given the opportunity to view the detailed comments and to set up a training schedule to cover weak points.

A brief example of an engineering observer's report form is given as follows:

Engineering Observer ____________________
Location ______________________________

1. Evaluation of the engineering department is based on: (a) extent of the department's preparation and fulfillment of the ordered conditions of readiness as appropriate to the problems, (b) extent of correct utilization of the engineering damage control features built into the ship, (c) extent to which proper engineering casualty control is accomplished, (d) extent to which on-station personnel take corrective action for control of damage, (e) adequacy of reports and dissemination of information, and (f) the general handling of the plant in accordance with good engineering practice, and the ability of the department to ensure maximum mobility and manueverability of the ship and to supply all necessary services to other departments in fighting the ship.

2. Hit ______________________
   Exercise ______________________
   - a. Preparation and status of the engineering plant.
   - b. Fulfillment of proper condition of readiness.
   - c. Fire and missile hazards.
   - d. Condition of firefighting and damage control gear.
   - e. Condition of personnel clothing and protection.
   - f. Stationing and readiness of personnel.
   - g. Investigation and interpretation of casualty.
   - h. Promptness and effectiveness in taking care of casualty.
   - i. Were proper doctrine and procedures used?
   - j. Were prompting and additional information given by observer?
   - k. Were proper reports made?
   - l. Readiness of standby units.
   - m. Readiness of alternate and emergency lighting and power.
   - n. Were proper safety precautions observed?
   - o. Material deficiencies.
   - p. Coordination of personnel.
   - q. Coordination of engineering spaces.

3. Main Engine Control. Receipt of vital interior communications, origination and transmissions of required reports to Conn, Damage Control Central, and other stations.

4. Action taken by main engine control:
   - a. Correct action.
   - b. Sound judgment based on good practice.
   - c. Assurance.
   - d. Speed.

5. Recommendations.

The blank parts of the observers' report forms are filled in as applicable to the individual observer's station. Items that were not observed by him are either left blank or crossed out. Additional information, if required for a certain exercise or condition, may be written on the reverse side of the form. A separate form or sheet is used for each exercise or drill. A report of the exercises conducted and the evaluation of the inspection are forwarded to the type commander.

BOARD OF INSPECTION AND SURVEY

The Board of Inspection and Survey is under the administration of the Chief of Naval Operations. The board consists of a flag officer, as president, and of such other senior officers as may be required to assist him in carrying out the duties of the Board. Regional Boards and Subboards are established, as necessary, to assist the Board of Inspection and Survey in the performance of its duties. The Subboards consist of a senior inspector, a captain, and about 10 or more members, depending upon the type of ship that is to be inspected. The President of the Board of Inspection and Survey determines and prescribes the procedures to be followed by the Board of Inspection and Survey, including the Regional Boards and Subboards, in the conduct of trials, inspections, and surveys.

Ships are presented to the Board of Inspection and Survey (INSURV) for preliminary acceptance trials, final acceptance trials, material inspections, and surveys. Preliminary and final acceptance trials are discussed in chapter 12 of this publication. A ship being inspected or undergoing trials by INSURV is considered as being on detached duty until the trial or inspection is completed.

INSURV MATERIAL INSPECTIONS

INSURV Material Inspections are conducted in accordance with statutory requirements of Congress that specify the material inspection of a U. S. Navy ship (1) upon the ship's return from a foreign station, (2) at least once every three years (if practicable), (3) when fitness of the ship for further service is in doubt, and (4) when the ship has been declared unfit and stricken from the Naval Vessel Register.

SecNav Instruction 5420.12 (revised) describes the organization of the Board of

176

Inspection and Survey, including the Regional Boards and Subboards. SecNav Instruction 4730.5 establishes the policy for conducting an INSURV material inspection of each active ship 4 to 6 months prior to the ship's next scheduled regular overhaul. (This normally exceeds the triennial inspection requirements). INSURV Instruction 4730.8 (revised) provides detailed guidance for the preparation and distribution of INSURV reports. INSURV Instruction 4730.9 (revised) provides detailed guidance concerning the preparations for and the conduct of INSURV material inspections (including condition sheets and general instructions for their preparation).

INSURV material inspections are conducted at such time and place as may be mutually agreeable to the Board and the type commander. The inspection starts promptly upon arrival of the Board, and the ship must be moored to a pier or dock during the inspection in order to permit disabling of machinery. INSURV material inspections are not normally scheduled during regular overhaul or tender availability, and repair work during an inspection should be kept to a minimum.

Approximately 30 days prior to the date of a scheduled INSURV material inspection, two copies of INSURV Instruction 4730.9 (revised) with enclosures) and copies of INSURV Instruction 4730.11 are forwarded by the Board to the ship to be inspected. The enclosures to INSURV Instruction 4730.9 (revised) include instructions and procedures for conducting material inspections of ships and the necessary condition sheets. Properly prepared condition sheets facilitate determination of the material condition of the ship. Sufficient blank condition sheets are forwarded to the ship with INSURV Inst 4730.9 (revised) to permit the preparation of an original and one carbon copy of each sheet. The original must be completed (legibly) describing the current material condition of the ship, and mailed to the Board in advance of the inspection. The carbon copy is retained on board. Detailed instructions for their completion are included in the condition sheets. It is very important to report deficiencies which require maintenance in excess of routine maintenance as well as equipment requiring repairs. All deficiencies in design, performance, and completeness or other defects must be reported.

In addition to the condition sheets, a list of work items must be prepared for submission to the Board conducting the material inspection. The list of work items should include all known or suspected work to bring the material condition of the ship to the required standard. The work items list should include the following:

1. Departures from CNO approved characteristics, contract plans, or specifications.
2. Incomplete or unsatisfactory tests.
3. Alterations desired.
4. Outstanding field changes or ShipAlts.
5. Equipments required by approved plans.
6. Partially complete installations.
7. Safety hazards.
8. Repairs required.
9. Equipments that fail to meet performance requirements, require excessive maintenance, leak excessively, are obsolete, are in excess of actual needs, or are unreliable in operation.
10. Work items outstanding from previous trials or material inspections.
11. Work items requiring further investigation.

The work items are prepared in accordance with the instructions detailed in INSURV Instruction 4730.11. A set of the work items will be delivered to the Board upon arrival. As a result of the material inspection, the Board members make any necessary changes, assign classification and identification symbols, and ensure that the ship and the type commander are forwarded copies of the work items as changed or corrected by the Board, along with copies of any work items originated by the Board.

The INSURV Board uses Arabic Numerals and combinations of lower case letters to identify work items as to reference number within the ship's departments (1, 2, 3, etc.) and the department or division of the ship having cognizance of the item. The following symbols are used to identify the ship's department or division having primary cognizance of a work item:

nv	navigation department
op	operations department
wp	weapons department
dk	deck division or department
mp	main engines division
br	boilers/reactors division
ax	auxiliaries division
el	electrical division
dc	repair division (damage control and hull structure)

sp - - - - - - - - - supply department
rp - - - - - - - - - repair department
md - - - - - - - - medical and dental departments
hb - - - - - - - - - habitability
av - - - - - - - - - air department

The INSURV Board inspects all parts of the ship including storerooms, magazines, operating spaces, voids, cofferdams, chain lockers, and tanks. The spaces will be opened for inspection in accordance with detailed instructions on the condition sheets. Personnel must be available to open locked spaces immediately upon arrival of the inspection parties. The personnel responsible for a space and the operation of the equipment therein must be present in the space to assist the inspection party by answering questions and operating equipment.

The operational aspects of all equipment and material will be examined during the conduct of the INSURV material inspection, with the exception of equipment opened or disassembled for a more detailed inspection. Detailed instructions for the preparation of equipment for inspection in each department are included with the condition sheets for the department. Examples of equipment that will be operated include:

1. Anchor engines.
2. Steering engines.
3. Deck machinery and rigging.
4. Lifeboat handling equipment.
5. Boiler safety valves on steaming boiler.
6. Overspeed tripping devices on generators and pumps.
7. Soot blowers.
8. Fire control systems.
9. Gun and missile batteries (in all methods of control).
10. Hoists.
11. Sprinkling systems.
12. All electronic equipment.

The INSURV Board members in attendance are considered to be the prime working group on board the ship. Stateroom accommodations must be furnished for each Board member. The staterooms provided must be equipped with chairs and writing desks for accomplishing (in privacy) the necessary paperwork incident to the conduct of the inspections. The ship is required to be prepared to furnish each Board member with a flashlight and a foul weather jacket for use during the inspection. In addition, hull members of the Board will be furnished a scraper and chipping hammer. Heads of departments, or their representatives qualified in the operational and material aspects of each department, must be prepared to accompany each Board member.

During the material inspection, the following records must be available for review by the various members of the INSURV Board:

1. Booklet of General Plans.
2. Ship Information Book (all volumes).
3. Records of watertight integrity tests.
4. Damage Control Book.
5. COSAL.
6. Docking report.
7. Departmental logs and performance records.
8. Waivers authorizing inactivation of major machinery and equipment (other than those disabled for the inspection).
9. Preventive maintenance organization, procedures, and records.
10. Corrective maintenance history.
11. Complete list of approved outstanding alterations.
12. Lists (by department) of items of major machinery and equipment inoperative due to lack of material and/or test equipment.
13. Ship's copy of the work items prepared for the INSURV inspection.

A critique is held upon completion of the INSURV material inspection. At the critique, each member of the Board reviews the results of his inspection and the ship's officers are afforded the opportunity to comment on the Board member's remarks. For small ships with relatively inexperienced heads of departments, each Board member states the results of his inspection in sufficient detail to fully appraise the commanding officer of the conditions found. Work items covering deficiencies corrected prior to the critique are removed from the work list.

The senior member of the INSURV Board conducting the material inspection submits a complete report of the results of the inspection (including the departmental evaluations, the inspectors' remarks, and the list of work items) to the President of the Board of Inspection and Survey, with copies to the appropriate type commander and other interested commands, bureaus, and offices of the Department of the Navy. The INSURV Board conducting a material inspection assigns no numerical grade or particular award of merit but simply finds that the ship is in a satisfactory or unsatisfactory material condition of readiness for war or for further naval service.

Whenever any significant unsatisfactory condition is disclosed during an INSURV material inspection, the senior member of the inspecting Board makes an advance report to the President of the Board of Inspection and Survey (copies to the appropriate fleet and type commanders and other interested commands, bureaus, and offices of the Department of the Navy) in order to ensure that corrective action is initiated promptly. The report, in the form of a speedletter, is forwarded no later than the next working day after completion of the inspection. Only those deficiencies considered to be of significance to the top levels of OpNav and the fleet and type commanders are included in the advance report.

Whenever, as a result of an INSURV material inspection or trial, the inspecting Board believes that the condition of the ship under inspection or trial is such as to reflect credit or discredit upon any officer attached to the ship, such opinion is made the subject of a separate letter addressed only to the officer's reporting senior with a copy to the officer concerned.

INSURV SURVEYS

Whenever the Chief of Naval Operations considers a ship to be unfit for further service due to its material condition, its obsolescence, or other circumstances, INSURV conducts a survey of the ship. After a through inspection, the Board renders an opinion to the Secretary of the Navy as to whether the ship is fit for further naval service or can be made so without disproportionate cost. If the Board deems the ship unfit for further service, and the cost of repairs or modernization are excessive, the Board recommends that the ship be disposed of in accordance with applicable law.

CHAPTER 9

FUELING SHIP

In order to carry out the Navy's mission, the fleet must be capable of remaining at sea for prolonged periods, fully ready to carry out any assigned task. Units of the fleet receive the logistic support they require by means of underway replenishment (UNREP).

Underway replenishment is accomplished primarily by means of intership horizontal transfers via rigs connecting the replenishment ships and the supported units. Horizontal transfers may be augmented by vertical transfers via helicopters.

The primary aim of underway replenishment is the safe delivery of the maximum amount of cargo in a minimum of time. The operation must be accomplished without interfering with the primary mission of the supported force.

The Naval Ship Systems Command prepares and issues type plans showing the make-up of fueling rigs and giving the bill of materials for fueling each type of ship. The fueling plans are general in nature and each ship of the type should adapt the plans to its own particular characteristics and equipment. The engineer officer (and fueling officer) should consult the fueling plans before fueling ship.

The Naval Ship Systems Command is constantly striving to improve present methods of fueling ship. The fueling at sea method presently used by the Command is the probe fueling system. The probe system employs a quick connect and disconnect probe and probe receiver. This system considerably shortens the time required for fueling some ships at sea and increases safety of personnel. (The double probe system is presently under development.) Ships are extremely vulnerable to attack during fueling-at-sea operations and any method that safely speeds up the operation is worthy of consideration.

This chapter mainly deals with the shipboard stowage of gasoline (including JP-5) and fuel oil as well as the procedures for receiving and delivering these fuels in port and at sea. It also includes a summary of the provisions of the Oil Pollution Acts of 1924 and 1961, followed by a discussion of practices intended to prevent oil spillage (and to limit spillage should it occur).

GASOLINE STOWAGE

Gasoline that is carried in cans for the ship's own use must be stowed in the paint and flammable liquids storeroom. In ships with no flammable liquids storeroom, gasoline must be carried in cans or drums so located on the weatherdeck (preferably near the stern of the ship) that the containers will not be in the vicinity of hatches, heat producing spaces (including the ventilation inlets or exhausts to such spaces), ready service magazines, or the line of fire of guns; and stowed (preferably in quick release type racks) so that the containers may be readily jettisoned. Before battle, gasoline carried in drums or cans on the weatherdecks must be jettisoned (with the drums and cans securely closed to minimize fire hazard from floating gasoline) except for such amounts as are necessary for operating gasoline powered emergency pumps.

Some naval ships are authorized to carry gasoline in drums and cases in packaged gasoline stowage compartments or as cargo in holds or between decks equipped with: (1) direct access to the weatherdecks; (2) explosive proof lighting fixtures; and (3) an adequate natural air supply and mechanical exhaust ventilation system. The hold must be separated from all other cargo by oiltight steel decks and bulkheads and not adjacent to machinery or boiler spaces or uptakes. Great care must be taken to ensure that only tight gasoline containers are stowed in the hold and that the containers are secured to prevent movement that might rupture them or cause sparks.

A hydraulic stowage system is installed in some naval ships other than oilers for the stowage of bulk gasoline. In the hydraulic stowage system, water admitted at the bottom of the stowage tank floats the gasoline to the delivery pipe connection at the tank top, thereby precluding space for the formation of an explosive mixture of air and gasoline vapors. The hydraulic system must not be filled beyond 95 percent gasoline and 5 percent water, or gasoline may be forced overboard through the overflow.

In ships with large bulk gasoline stowage capacities such as aircraft carriers and seaplane tenders, the cofferdams surrounding the gasoline stowage tanks are charged with an inert atmosphere (50 percent nitrogen or 35 percent carbon dioxide) at 8 ounces per square inch. In addition, the associated gasoline piping is purged and charged with the inert gas.

Every precaution must be taken to guard against fire during gasoline handling operations. Safety precautions applicable to gasoline handling operations are contained in (1) Naval Ships Technical Manual; (2) Replenishment At Sea, NWP 38 (C); and (3) Naval Air Operations, NWP 41 (C). The engineer officer and fueling officer must frequently review the safety precautions in order to ensure that necessary precautions are observed during all gasoline handling operations. The aforementioned publications also contain safety precautions for fueling operations involving the handling of other fuels (Navy Special Fuel Oil, diesel oil, and JP-5).

FUEL OIL STOWAGE

Fuel oil tanks are an integral part of the ship's structure and may be located forward and aft of the firerooms and enginerooms, abreast the firerooms and enginerooms, and in double-bottom compartments (though not in double-bottom tanks directly under boilers). Detailed information concerning the location and capacity of fuel tanks in each ship or each class of ships is provided in the Ship Information Book and in the flood effect or liquid loading diagram in the ship's Damage Control Book.

Most naval combatant ships are equipped with a water ballasting system that provides for flooding certain selected fuel oil tanks from the firemain system or a directly connected sea valve arrangement, and for drainage through the main drain or the fuel tank stripping system. Proper use of the water ballasting system ensures satisfactory stability at sea, provides additional torpedo protection, and aids in the prevention of an initial list in case of underwater damage. When water ballast has been used in a fuel oil tank, the tank must be emptied of all water insofar as possible before being filled with fuel oil, and tanks should be empty of fuel oil before ballast is admitted.

The amount of free surface in ship's tanks containing liquid must be kept to a minimum or the resultant reduction in the stability characteristics of the ship will cause the ship to be more sensitive to heeling moments. As many fuel oil tanks as possible should be kept filled to 95 percent capacity in order to maintain a minimal amount of free surface. The engineer officer should make certain that only the fuel oil tanks actually in use will be partly full. Cross connections between partly filled wing tanks must be kept closed in order not to aggravate the effect of the free surface in the tanks. The oil level may be equalized in the different stowage tanks or trimmed (when appropriate) from one tank to another by pumping through the combined suction and discharge manifolds at the transfer pumps (or transfer and booster pumps). The oil level may be partially equalized by gravity flow through the manifolds or sluice valves.

The interior of a fuel oil tank is not painted but is protected from corrosion by maintaining an oil film on the inner surfaces of the tank. To implement this protective feature, all fuel oil tanks must be filled with oil (to overflow capacity) at least once each year. Whenever a fuel oil tank is cleaned and made safe for the entry of personnel (for any reason whatever), a complete inspection of the tank and a test and inspection of the heating coils therein must be made. Every 18 months or during a regular overhaul, at least 10 percent of the fuel oil tanks which have contained salt water ballast must be cleaned and inspected. The tanks chosen to be inspected should be those that (because of salt water flooding or for some other reasons) may be expected to be in the worst condition.

FUELING AT SEA

The term "fueling-at-sea" is applied to the operation of transferring fuel from one ship to another in an open sea while the ships are underway. The fuel transferred is supplied to a combatant ship by a tanker, tender, or larger combatant ship. A complete description of the fueling-at-sea operation is covered in Replenishment at Sea, NWP 38 (C), promulgated by the Chief of Naval Operations. The discussion which follows is concerned with general fueling procedures.

Prior to or coincident with the completion of fueling ship, a copy of the analysis of the Navy Special Fuel Oil (NSFO) actually delivered is furnished the commanding officer of the ship fueled by the fueling officer of the supplying activity when NSFO is received from a Navy storage tank, naval barge, or another naval ship. The engineer officer or fueling officer of the ship receiving NSFO should (when practicable) witness the taking of thief samples from the tanks of the supplying activity before fueling commences and after fueling is completed. The samples must be tested by centrifuge to determine the bottom sediment and water contained in the oil, and the average percentage of the samples is considered to be the true percentage. When fueling at sea or if for other reasons, the supplying activity is unable to furnish a complete, properly witnessed analysis of the oil, the supplying activity, in lieu thereof, must furnish the American Petroleum Institute (A.P.I.) gravity and bottom sediment and water analysis of a composite sample taken from the tanks from which the oil was delivered. In addition, the ship being fueled must take samples of the oil during the fueling to determine the bottom sediment and water content. The ship being fueled should take the necessary action to discontinue fueling at any time a sample shows the water content of the oil to be sufficient to cause unreliable operation. The procedures for testing fuel oil thief samples are prescribed in the Naval Ships Technical Manual, and are described in Engineering, Operation and Maintenance, NavPers 10813-B. The engineer officer is responsible to the commanding officer for the quality as well as the quantity of fuel oil received by the ship.

Before fueling from a commercial supplier, an initial thief sample must be taken and tested by centrifuge to determine if the water content is sufficient to cause unreliable operation. Fueling may commence if the sample does not show an unacceptable percentage of water after the first 10 minute period of the centrifuge test.

Oil in the ship's fuel oil storage tanks and service tanks must be tested for water contamination at least once each week and before being drawn upon for use. Before fuel oil is transferred to a fuel oil service tank or before a service tank is lined up for service suction, the tank from which the oil is to be drawn must be tested, and (if necessary) rendered safe from water contamination by stripping.

In an emergency, a naval ship normally using NSFO may have to use a substitute fuel. To determine its acceptability for use in naval boilers, tests must be conducted on the viscosity, flash point, sediment and water content, and explosivity of the substitute fuel. To be acceptable, the substitute fuel must meet the test limits prescribed in chapter 9550(55) of the Naval Ships Technical Manual.

Fuel transfer between ships underway must be made at the highest practicable rate and in the shortest practicable time consistent with safety. To this end, the engineer officer must see that all preparatory steps required to be taken by his department are completed properly and well in advance of scheduled fueling at sea. Distribution of the fuel, providing the necessary tools at the fueling connections, testing of sound-powered telephone circuits, segregation of the fuel transfer system, and manning of the fueling stations, if not done on time (or if done improperly) can delay or slow the fueling operation. During the transfer the engineer officer must keep the commanding officer and the officer of the deck informed of the progress and estimated time of completion of the fuel transfer. He is usually required to give the commanding officer 15, 10, and 5 minute warnings prior to the completion of fueling.

Fleet oiler cargo load capacities normally vary (according to class) from 121,000 to 180,000 barrels. Approximately 70 percent of the load is NSFO, 26 percent is JP-5 fuel, and 4 percent is aviation gasoline. Approximately 500 tons of lubricating oil can be carried in deck stowage on fleet oilers. When fueling two large ships at maximum pumping rate, many fleet oilers are limited to approximately 12 knots speed due to the power required to operate the necessary fuel pumps and cargo winches.

RECEIVING FUEL OIL

In selecting stations to receive the fueling hose, large surface ships must consider the following:

1. The position of the end of the hose sent over by the oiler is fixed by masts or king posts and booms.
2. An adequate working space must be provided.
3. Even with permanent fueling connections close by the fueling stations it is sometimes desirable to use several sections of hose to afford flexibility in making up the coupling. This is usually accomplished by running hose across the ship from the opposite side to the fueling station. This is not done in destroyers that fuel by the open-trunk method, but it is useful in ships that fuel through flanged connections that were poorly located in the original design.

Personnel are assigned to fueling-at-sea stations in accordance with the ship's underway replenishment (UNREP)bill in the Ship's Organization And Regulations Manual. In addition to the transfer of fuel, the ship's underway replenishment bill also provides for the transfer of provisions, supplies, ammunition, and weapons.

Although the operation of particular interest to the engineer officer is the transfer of fuel, all replenishment at sea operations attach a vital responsibility to him. During replenishment, with ships cruising side by side and trussed together with high-lines, hoses, or burton rigs, engine operating reliability, correct response to engine orders, and precise control of engine speed are of utmost importance. Under such circumstances, an engineering casualty or an error by a watchstander can have serious consequences. To minimize the possibility of mishap and to ensure precise control of engine speed, the engineer officer should take certain precautionary measures before his ship takes station for a replenishment operation. These measures include:

1. Operating the engineering plant in split-plant condition, if practicable.
2. Ascertaining that fuel oil tanks on suction contain sufficient oil so as to minimize the possibility of a loss of fuel oil suction casualty, as well as to avoid the necessity of shifting suction while alongside.
3. Stationing fully qualified men at the throttles and other important stations in the enginerooms and firerooms, as well as in the steering machinery room.
4. Ensuring that all communication circuits needed for maximum operating reliability of the plant are fully manned.

The fueling-at-sea detail of the engineering department (mainly personnel of the B division) is under the direction of the engineer officer and (on most ships) functions with a fueling officer (B division officer) in charge. Approximately one hour prior to manning stations for fueling at sea:

1. The engineer officer notifies the officer of the deck of the fueling stations to be used, the approximate amount of fuel required, and the approximate time required to fuel the ship.
2. The oil king ensures that the necessary temporary sound-powered telephone circuits are rigged and sets up the fueling board, indicating thereon the tanks and piping systems in use. (Operation of the engineering plant must be split, if practicable, with the isolation of fuel suctions ensured.)

The fueling detail of the engineering department should man fueling-at-sea stations approximately one-half hour prior to the expected time of approach alongside the ship that will deliver the fuel. All exposed personnel of the fueling detail in the vicinity of weatherdeck fueling stations or other hazardous locations must wear orange-colored, inherently buoyant life jackets and helmets. Upon manning fueling stations:

1. Telephone talkers must don and test all sound-powered telephone sets, including the sets to be used between ships.
2. The fueling officer must ensure that suitable equipment for the control of oil spillage (drip pans, rags, and old canvas) is available at each fuel receiving station. In addition, shores should be provided to place under the end of the fueling hose in order to raise it off the deck, if necessary.
3. The fueling detail must open the necessary fueling trunk tops on some destroyer types. On other ships, they must connect sufficient hose to fueling connections to provide a straight lead to the end of the delivery hose.

The officer of the deck is notified when the fueling detail is manned and ready. During fuel transfer the smoking lamp is out and word to that effect must be periodically passed over the general announcing system.

When the delivery hose has been received aboard the ship being fueled, the hose is coupled to the ship's quick-release fueling connection or the probe to the receiver (or secured in the fueling trunk of some destroyer types). The procedure for fueling after the delivery hose is connected includes the following steps:

1. Notify the officer of the deck when the delivery hose is connected and ready to receive fuel, and request permission to notify the delivery ship to commence pumping. Record the time of commencement on the Fueling Memorandum (discussed in detail in chapter 6).
2. Pass the word over the fueling station phone to the delivering ship to start pumping at a slow rate or at a certain pressure. When it is certain that the tanks are filling properly, request the delivering ship to pump at maximum receiving ship rate.
3. When the temperature of the oil steadies, record that temperature (on the fueling memorandum) as the pumping temperature. This information may be obtained from the delivering ship.
4. Fuel should be discharged into at least four tanks simultaneously from each fueling connection. The oil king must keep a constant check on the rate and percentage of filling. When a tank is about 85 percent full, he should have the valve to that tank throttled down to top off the tank slowly to 95 percent of capacity. At the same time, he should have the valve of the tank next in the filling sequence opened. Fuel should not be directed to an overflow tank until all tanks served by the overflow tank have been topped off. The possibility of oil spillage can be held to a minimum by following this procedure.
5. The fueling officer must ensure that the oil king or his chief assistant (located in the oil and water laboratory and in constant communication with all stations) keeps the fueling board up to the minute, notifying the manifold operators when and which valves to open and close.
6. Keep the commanding officer informed as to both percentage of the tanks filled and estimated time to complete fueling.
7. Take samples in small quantities during fueling to accumulate a total sample of not less than 5 gallons (for determining water content and bottom sediment).
8. When word has been received that the last overflow tank has been filled, order the delivering ship to have the pumps stopped. (When two fueling stations are used, both stations may not finish simultaneously; in fact, one may have to let the hose go before the other finishes.)
9. Record time of completion in the fueling memorandum.
10. Empty the fueling hose (if the rig is equipped with a quick-closing valve or a probe, it is not necessary to empty the fueling hose). The hose may be emptied by the delivering ship by blowing it down with air or by taking a back suction. Either procedure takes about 3 minutes to complete and the receiving ship must not disconnect the hose (or remove the hose from the fueling trunk) for at least that length of time after the order to stop pumping has been given.
11. Sound the fuel tanks.
12. Uncouple the fueling hose.

DELIVERING FUEL OIL

Some naval ships other than oilers are equipped to deliver fuel at sea to other ships. Cruisers and carriers and destroyer tenders are equipped to deliver fuel (NSFO) to destroyers and smaller ships. When a ship is requested to fuel another ship, the engineer officer of the delivering ship (normally referred to as the control ship) will generally be notified sufficiently well in advance to make adequate preparations.

Preparatory to delivering fuel oil (NSFO) at sea, the delivering ship should:

1. Fill (to 95 percent capacity) the largest tanks (nearest the pumps and normally used risers) that will more than adequately hold the amount of oil to be delivered.
2. Heat the oil to be delivered to 90° F. The temperature of the fuel oil, in any case, should not exceed 120° F.
3. Sound the tanks to be used and accurately determine how much fuel is in them.
4. Line up the piping system to be used and test the pumps for proper operation.
5. Make up the fueling hose.
6. Designate the fueling stations to be used.
7. Take the ship's draft.
8. Rig sound-powered telephone sets and test them.
9. Prepare the fueling board in the fuel and water laboratory.

The procedure for delivering fuel (as far as the engineering department is concerned) is very similar to the aforementioned procedure

184

for receiving fuel. The temperature of NSFO being delivered should be 90° F. Pumps should be slowed when the tanks of the receiving ship approach 85 percent of capacity. Following the fueling operation, the engineer officer of the delivering ship must forward a copy of the fueling memorandum to the commanding officer of the receiving ship.

EMERGENCY BREAKAWAY

During underway replenishment, emergencies may arise that require an emergency breakaway. An emergency breakaway is basically an accelerated standard breakaway using an orderly and prearranged procedure. The objective is to disengage quickly without damaging the rigs or endangering personnel.

The basis for proper preparation for an emergency breakaway is the assignment of specific duties to each man at each underway replenishment (UNREP) station. Emergency breakaway duty assignments and procedures should be outlined in a separate section of the ship's underway replenishment bill. All personnel involved in UNREP must be thoroughly briefed on the entire evolution prior to any UNREP. Periodic "walk through" drills should be conducted to ensure a satisfactory level of understanding. These basic points must be covered:

1. Review of ship's UNREP bill, emergency breakaway procedures and personnel duty assignments.
2. All associated internal and external communications, including visual signals.
3. The use of emergency breakaway tools such as an axe, hatchet (hand), marlinespikes, and pole cutters, wire rope. (NOTE: Emergency tools are stowed in a tool box readily accessible to each station. The tools are considered an integral part of the transfer station equipment and must not be used for any other purpose. Additional information on types and uses of emergency tools can be obtained from Replenishment At Sea, NWP 38C).
4. The use of equipment to reduce the extent of damage, retrieve the rigs, and effect prompt repairs. Special equipment, such as carpenter stoppers, wire clips, and chain stoppers should be included.
5. The organization for making repairs.
6. The location of spare gear that may be required to return an inoperable station to full operation as soon as possible.

An emergency may occur at any moment during the fueling at sea and preparation for breakaway must begin on receipt of the first line. All lines must be faked clear for running as they are brought on board. The lines must also be maintained faked down during the replenishment. Fueling hoses must be provided with quick-release couplings for connection to the ship being fueled. Two types of quick-release couplings are now in use. One coupling is the 6 inch breakable-spool quick-release coupling; the other is the combined quick-release (Robb) coupling and valve.

All tankers are supplied with both the A end and the B end of the breakable-spool quick-release coupling, shown in figure 9-1. Tankers normally have the A end installed on the cargo manifold or on a length of hose or pipe connected to the manifold. The fleet unit sends over the hose fitted with the B end of the coupling.

Some tankers may be supplied with the male end of the Robb coupling, shown in figure 9-2. This is the preferred coupling and, if available, should be used. Like the A end of the breakable-spool coupling, it is installed on the manifold or the hose extension, ready for connection with the female end that comes over with the hose from the fleet unit. Care should be used to avoid dropping and damaging the Robb coupling; particular care is required when the pelican hook (an integral part of the swivel fitting) is released.

The A end of the breakable-spool quick-release coupling (fig. 9-1), rigged on the ship being fueled (receiving), is a cast iron spool with a standard hose flange on one end and a slotted flange on the other end. A deep annular groove, machined around the spool, allows the coupling to be broken with a sharp blow. All ships not equipped with fueling trunks are provided with the A end. The B end of the coupling, attached to the end of the hose passed by the delivery ship, is a similar spool with a hose flange on one end. The other end of the B end of the coupling is fitted with a floating ring flange equipped with drop bolts. The ring can be quickly rotated to line up the drop bolts with the slots in the A end of the coupling. The floating ring flange is fitted with a gasket to ensure an oiltight fit when the A and B ends are connected together. The coupling is designed to withstand the normal stresses of the fueling operation, but a sharp blow on the annular groove of the A end with a 10 or 12 pound

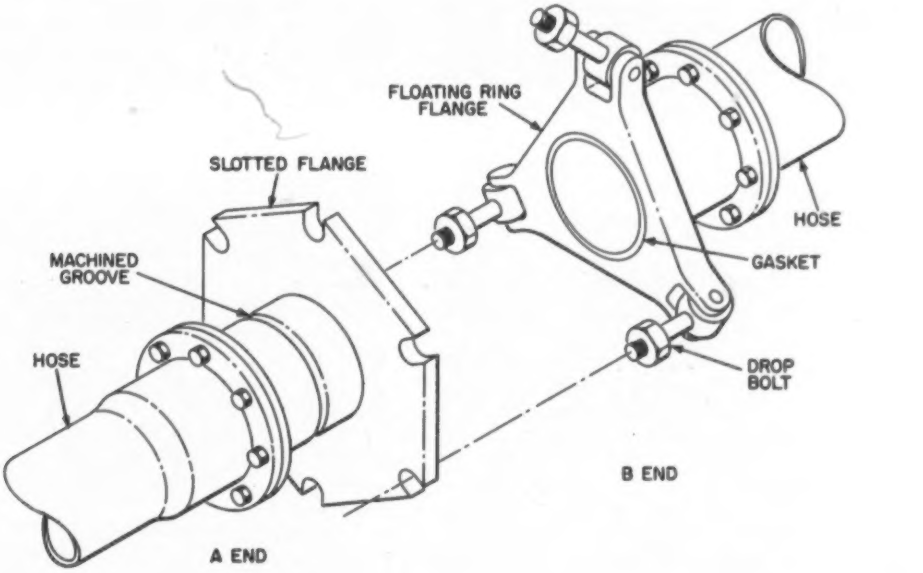


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Figure 9-1.—The breakable-spool quick-release coupling.

sledge will cause it to break. The B end of the coupling is closed with a blank flange while being passed between ships; this prevents oil from spilling and water from entering the hose.

The combined quick-release coupling and valve, shown in figure 9-2, is used to fuel ships with closed fueling systems. The coupling consists of a male end, attached to the fueling manifold on the receiving ship, and a female end, secured to the end of the hose sent over by the delivery ship. The male end, a slightly tapered tube with a machined annular groove (one end) and a standard hose flange (other end), contains an activating cam linked to an operating lever. The cam is designed to open a spring-loaded valve disk in the female end when the two ends are coupled together and the lever is operated. The male end is bolted to a breakable spool (to facilitate emergency breakaway) mounted on the fueling station manifold (or a length of fueling hose) on the ship being fueled. The female end is a cylindrical body designed to fit over the tapered end of the male end, and contains a spring loaded sleeve and valve.

When the two ends of the combined quick-release coupling and valve are properly coupled together, the spring-loaded sleeve (female end) forces a spring-tensioned metal ball race into the annular groove (male end) thereby locking the two ends together. The two ends of the coupling must be perfectly aligned and not under stress before they can be coupled or uncoupled. When the sleeve (female end) is forced backward by hand (or, as is usually necessary, by pry bar), tension on the ball race is released and the two ends can be parted. Slots are provided in the sleeve to allow for the insertion of pry bars to aid in the uncoupling. A gasket in the female end provides a tight joint when the two ends are joined.

For the delivery of fuel to ships equipped with fueling trunks, or open fuel systems (such as destroyers and other small ships), a 4-inch terminal hose (pigtail) fitted with a hose cap is attached to the combined quick-release coupling and valve, and sent over on the fueling hose. The operating handle of the coupling is secured in the open position and the hose cap prevents oil spillage during transfer of the fueling hose. For other ships, only the female-end is sent over with the fueling hose.

Examples of conditions which warrant ordering an emergency breakdown are as follows:

1. When either ship experiences an engineering casualty that affects her ability

to maintain the replenishment course or speed.

2. When an enemy contact is reported that presents immediate danger to the force.
3. When a carrier must break off for an emergency launch or recovery of aircraft.
4. When an oiler and a receiving ship separate by more than 240 feet when using double rigs (or 280 feet when using single rigs) and the ships are still opening. Oilers must stop pumping before these limits are reached.

The order for an emergency breakaway may be given by the commanding officer of either the receiving ship or the delivery ship. Paramount in ordering an emergency breakaway is the allowance of sufficient time for the ships to disconnect the rigs in an orderly manner.

Sound-powered telephones and hand signals should be the primary means of communications for ordering an emergency breakaway because of the minimal amount of noise generated; however, bull horns and voice radio circuits should be used, if necessary, to ensure rapid ship-to-ship communications. The danger signal shall be sounded on the ship's whistle to alert all ships in the vicinity.

On receipt of the order for emergency breakaway, the delivering ship must immediately stop pumping and retrieve all tended lines. The delivering ship signals the ship being fueled when pumping has stopped, and

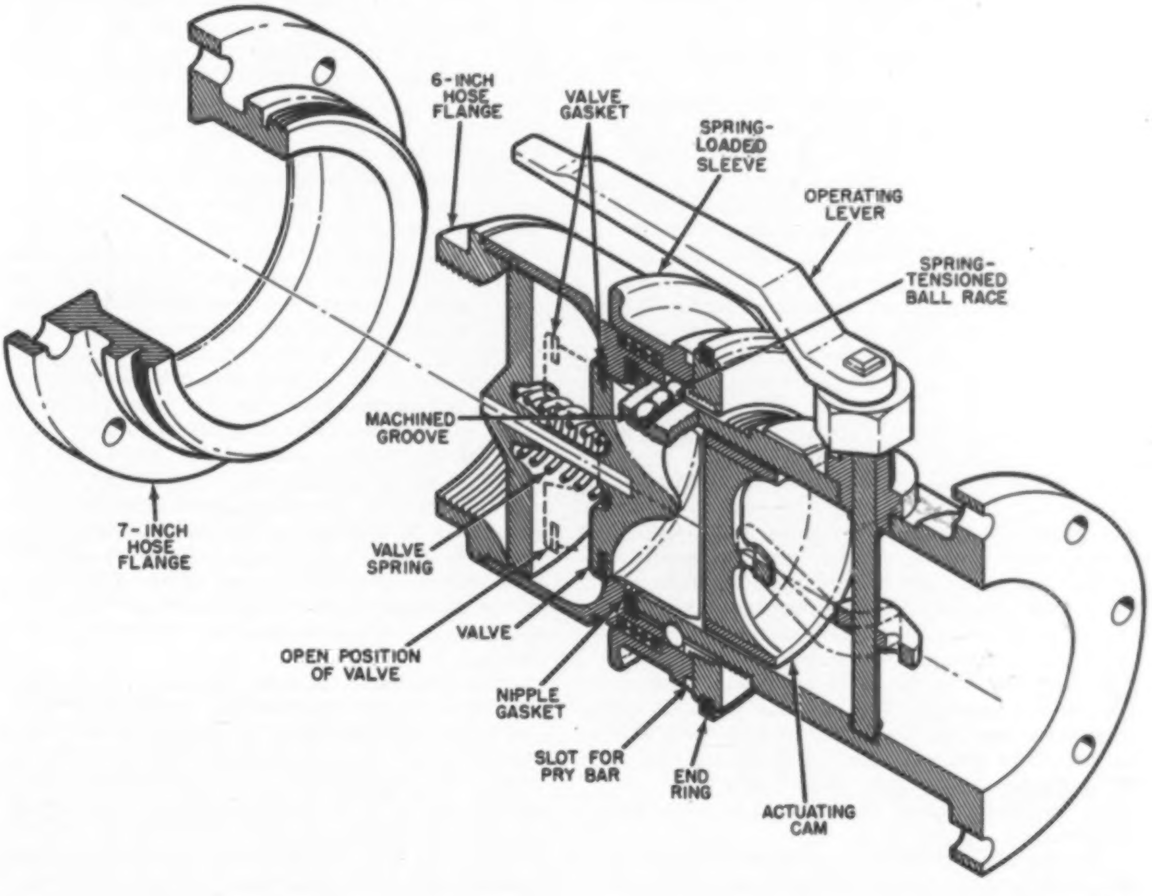
6-INCH HOSE FLANGE
VALVE GASKET
SPRING-LOADED SLEEVE
OPERATING LEVER
SPRING-TENSIONED BALL RACE
MACHINED GROOVE
7-INCH HOSE FLANGE
VALVE SPRING
VALVE
OPEN POSITION OF VALVE
NIPPLE GASKET
SLOT FOR PRY BAR
END RING
ACTUATING CAM

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Figure 9-2.—The combined quick-release coupling and valve.

the ship being fueled disengages the quick-release coupling and casts the fueling hose overboard.

All hands in the fueling detail must be indoctrinated in the dangers of emergency breakaway. Any line which is suddenly released from heavy strain tends to whip and can cause casualties to personnel. All running lines such as highlines, inhauls, outhauls, and saddle whips must be faked down free for running in case an emergency breakaway becomes necessary. During emergency breakaway, all lines must be cleared expeditiously.

Additional information concerning procedures to be followed during special fueling operations can be obtained by referring to Replenishment At Sea, NWP 38 (C).

TRANSFERRING GASOLINE AND JP-5

Fueling-at-sea procedures for the transfer of gasoline and JP-5 differ somewhat from the procedures for the transfer of NSFO. (Diesel oil is not normally carried by fleet oilers, however, JP-5 fuel can be used as a substitute.) The special procedures required for the transfer of gasoline and JP-5 include:

1. Carbon dioxide or inert gas (instead of air) must be used to blow down the hose after completion of the transfer of gasoline.
2. Only a combined quick-release coupling and valve made of nonferrous metal is permitted for use with gasoline and JP-5. The breakable-spool quick-release coupling must never be used with gasoline and JP-5.
3. When delivering gasoline, in addition to the electrical bonding wires fabricated in the hose wall, a bonding cable must be connected to both hose terminals as an added precaution to guard against fire resulting from accidental failure of the hose. The insulated bonding cable is connected to the source of supply (delivering ship) and the receiving inlet, with sufficient slack in the cable to prevent tension. Size of the bonding cable and the methods for connecting and disconnecting it are described in detail in chapter 9150 (15) in the Naval Ships Technical Manual. The cable must remain connected until the hose has been uncoupled.
4. For the delivery of gasoline or JP-5 to ships other than carriers, fleet oilers can pass over a 2 1/2 inch hose. For the transfer of gasoline or JP-5 to carriers, oilers can pass over a 6 or 7 inch hose fitted with the female end of a nonferrous combined quick-release coupling and valve.

THE OIL POLLUTION ACTS

The Oil Pollution Act, of 1924 (as amended) stipulates that, except in case of an emergency imperiling life or property, or unavoidable accident, collision or stranding, and except as may otherwise be permitted by certain regulations, it shall be unlawful for any person (including any officer or employee of the United States) to discharge, or suffer, or permit the discharge of oil of any kind or form (including fuel oil, oil sludge, and oil refuse) by any method, means, or manner into or upon the coastal navigable waters of the United States. Coastal navigable waters of the United States means all portions of the sea within the territorial jurisdiction of the United States, and waters navigable in fact in which the tide ebbs and flows.

The Oil Pollution Act of 1961 extends the provisions of the 1924 act by prohibiting the discharge into the sea of oil and water containing oil within 50 miles of any land, and establishes certain prohibited zones which in some areas extend as far as 150 miles from land. In accordance with the provisions of the Act of 1961, the discharge of oil or an oily mixture is not deemed unlawful when such action is required (1) for the safety of the ship, (2) for the prevention of damage to the ship or its cargo, and (3) for the saving of life at sea. In addition, the escape of oil or an oily mixture is not considered unlawful if it results from damage to the ship or from unavoidable leakage, provided that all reasonable precautions have been taken, after occurrence of the damage or discovery of the leakage, for the purpose of preventing or minimizing the escape.

The engineer officer should ensure that personnel of the engineering department are aware of the importance of preventing the contamination of inland waters, harbors, and coastal waters by oil spillage. All engineering personnel should be familiar with the provisions of the Oil Pollution Acts of 1924 and 1961. Copies of the Oil Pollution Acts should be maintained in the log room. There are engineering practices that, if followed, should prevent or minimize oil spillage in waters where the resultant contamination is likely to cause damage.

When the ship is located in waters within the limits defined in the Oil Pollution Acts (1924 and 1961):

1. Do not normally transfer fuel oil while the ship is underway. This practice not only reduces oil spillage (with its consequent wide dispersal due to the movement of the ship), but also reduces the possibility of an engineering casualty in restricted waters.

2. Limit the transfer of fuel oil to daylight hours, and establish and maintain sound-powered telephone communications between competent personnel stationed at all tanks and pumps involved in the fuel transfer and at lookout stations so located that personnel can observe fuel tank air vents and overflows at all times.

3. Do not discharge ballast overboard from piping or tanks except into a sludge barge or an oil-water separator.

4. Establish in each watch section an organized oil pollution party instructed in and capable of localizing, containing, and disposing of oil spillage and slicks.

5. Indoctrinate and instruct all personnel who man watchstations on weatherdecks (whether moored, at anchor, or underway) in observing, recognizing, and reporting all oil spillage and oil slicks.

Pump all bilges prior to entering waters within the limits defined by the Oil Pollution Acts. Within restricted waters, bilges may be pumped to contaminated tanks or to other tanks (ballast or fuel) temporarily designated by the engineer officer to receive bilge water pending its disposal in safe unrestricted areas at sea. In many ports sludge barges are available for the disposal of bilge water.

When an oil spillage occurs or oil is detected on the water within the areas defined in the Oil Pollution Acts, the oil spillage or slick must be reported in accordance with current local instructions. Failure to report an oil slick always aggravates the situation because it generally appears that an attempt has been made to conceal the spillage. In addition to reporting the oil slick, immediate action must be taken to arrest, contain, and erradicate it. The oil pollution party and all other available facilities should be used for this purpose. If the spillage is located between ships, fire hose streams directed into both ends of the slick can effectively contain the oil for hours. Boats equipped with portable fire pumps can be utilized to contain oil slicks that are less localized. Boats must be downstream from the slick and hose streams should be directed toward the center from around the periphery of the slick. Caught in time, oil can be absorbed and effectively sunk by spreading carbonized sand over it.

It should be noted that there are chemicals available on the market and in the supply system that completely emulsify black oil. (One product is called "spill remover.") There is no comparison between carbonized sand and an emulsifying chemical for NSFO spills.

189

CHAPTER 10

SHIP AVAILABILITIES

As it applies to work on naval ships, an AVAILABILITY is the period of time assigned a ship by competent authority for the accomplishment of corrective maintenance at a repair activity. During certain availabilities, a ship may be incapable of engaging in fleet operations and the operating schedule is adjusted accordingly. Only the authority granting the availability can alter or extend the period of the availability; however, a repair activity may request that the ship's availability be extended so that work can be completed or recommend a completion date to the authority granting the availability.

In accordance with the listing in the equipment identification code manual (EIC) for the 3-M system, there are several types of ship availabilities. These availabilities vary with the purpose for their assignments. A RESTRICTED AVAILIBILITY is an availability for the accomplishment of specific items of work by a repair activity, normally with the ship present, during which period the ship is rendered incapable of fully performing its assigned mission and tasks due to the nature of the repair work. (This availability applies to shipyards only.) A TECHNICAL AVAILABILITY is an availability for the accomplishment of specific items of work by a repair activity, normally with the ship not present, during which period the ship's ability of fully performing its assigned mission and tasks is not affected by the nature of the repair work. (This availability applies to shipyards only.) A REGULAR OVERHAUL is an availability for the accomplishment of general repairs and alterations at a naval shipyard or other shore-based repair activity, normally scheduled in advance and in accordance with an established cycle. VOYAGE REPAIRS, which apply to shipyard work only, are emergency repairs necessary to enable a ship to continue on its mission and can be accomplished without requiring a change in the ship's operating schedule or the general steaming notice in effect. A REGULAR TENDER AVAILABILITY is an availability for the accomplishment of general repairs and authorized alterations which are beyond the capacity of the ship's force alongside a tender or repair ship. It is normally scheduled in advance. An EMERGENCY TENDER AVAILABILITY is assigned to a ship for the purpose of rendering repairs to specific casualties. Emergency work takes first priority on a tender capacity. A PARENT TENDER/AUTOMATIC AVAILABILITY is an availability for the accomplishment of items of work usually on ship-to-shop basis. The repairs are normally of a nonoperational nature and done by a tender or repair ship on an unscheduled basis. A CONCURRENT AVAILABILITY is an availability for the accomplishment of ship-to-shop work by the tender or repair ship scheduled to coincide with the regular shipyard overhaul, or restricted availability. A SUPPORT AVAILABILITY is an availability for the accomplishment of specific items of work for units or command, other than a ship, such as an afloat staff or shore-based activity. An NRT SHIP AVAILABILITY is any availability for the accomplishment of work for a naval reserve training ship. A SUPPLY AVAILABILITY is a period of time assigned a ship for the uninterrupted accomplishment of a supply overhaul. A supply overhaul is the work involved in the purification and adjustment of on-board stocks and records to bring them into conformity with prescribed allowances or other stockage objective criteria. A supply availability is normally scheduled to coincide with a regular overhaul.

In addition to the definitions of the availabilities assigned naval ships, the procedures for the accomplishment of the shipwork (alterations and repairs) associated with ship availabilities and the repair activities that accomplish the work are discussed in this chapter. The engineer officer is directly concerned with almost all work accomplished on his ship by a repair activity, and should be familiar with the procedures that will obtain the best work possible within the limits of the funds available.

REPAIR ACTIVITIES

Ships can operate only a certain length of time without repairs. To keep a ship in prime condition, constant attention should be given to material upkeep and definite intervals of time must be allotted for general overhaul and repair.

Even when regular maintenance procedures are carefully observed, accidents and derangements may necessitate emergency repair work. Repairs and alterations to naval ships may be accomplished by forces afloat (including repair activities afloat) or repair activities ashore. Repair activities afloat include repair ships and tenders. Repair activities ashore include naval shipyards, private shipyards under contract with the Navy, and naval ship repair facilities (usually located outside the continental limits of the United States). The repairs and alterations that are within the capacity of a ship's force are accomplished by the ship's force. Repairs and alterations that are beyond the capacity of a ship's force may be accomplished by repair activities afloat or ashore as directed by the cognizant type commander or other authority assigning the availability.

Repair ships and tenders are normally available to fleet and type commanders for the accomplishment of regular tender availabilities, emergency tender availabilities, parent tender/automatic availabilities, and concurrent availabilities. Work that is beyond the capacity of the repair ships and tenders may be accomplished by repair activities ashore. In addition to the type of work requested, the availability of funds and the workload of available repair activities govern the assignment of repair work that is beyond the capacity of the ship's force.

The placement and administration of contracts for the repair or overhaul of naval ships at private shipyard are functions of an Office of the Supervisor of Shipbuilding (SUPSHIP) of the naval district in which the shipyard is located.

Before proceeding with the sections covering ship's force and repair ships and tenders maintenance and repairs, it will be most helpful to define repairs and alterations.

REPAIRS AND ALTERATIONS

Corrective maintenance to ships may be divided into the general categories of (1) repairs, (2) alterations, and (3) alterations equivalent to repairs.

A **REPAIR** is defined as the work necessary to restore a ship or an article to serviceable condition without change in design, in materials, or in the number, location, or relationship of parts. (Repairs may be accomplished by ship's force, by repair ships and tenders, or by naval shipyards or other shore-based activities.)

An alteration to a naval ship is any change in the hull, machinery, equipment, or fittings that involves a change in design, materials, number, location, or relationship of the component parts of an assembly regardless of whether it is undertaken separately from, incidental to, or in conjunction with, repairs. Requests for alterations may originate with the Naval Ship Systems Command, the forces afloat, or the Chief of Naval Operations (CNO).

A prime responsibility of the Naval Ship Systems Command for ship maintenance is that of administering alterations under its technical cognizance. In its day-to-day relations with the forces afloat, the naval shipyards, private industry, and research centers, the Naval Ship Systems Command keeps informed of technical developments. In striving to maintain the ships of the fleet in as efficient and modern a state as possible, the Naval Ship Systems Command may determine that a particular ship or class of ships should be altered to encompass desired improvements. These alterations may be changes to the hull, such as changes to bulkheads that will strengthen them or changes to deck arrangements that will provide space for installation of machinery; changes to machinery or the substitution of newer and more efficient machinery; changes to equipment, such as the replacement of an item with a more efficient type; or changes in design, such as the installation of a paint mixing and issue room.

When the commanding officer of a ship considers an alteration necessary for the satisfactory performance of his ship, he addresses a request for the alteration to the Naval Ship Systems Command via the established administrative chain of command. Copies of the request are sent to all ships of the type within the appropriate fleet for comments as to applicability.

Another source of alterations is the reports of the Board of Inspection and Survey (discussed in chapter 8). Upon completion of each material inspection, the Board, in its report of the general condition of the ship and its suitability for further naval service, furnishes a list of repairs, alterations, and design changes, which, in its opinion, should be made. Alterations recommended by the Board of Inspection and Survey normally are not acted upon by the Naval Ship Systems Command until after the receipt of appropriate requests from the commanding officers of the ships inspected and the recommendations of the type commanders.

Alteration requests addressed to the Naval Ship Systems Command are endorsed by the type commanders (or other administrative commanders, as appropriate), with their recommendations as to approval, classification, and applicability to other ships of the type. Copies of the basic request and endorsements are forwarded to other type commanders concerned, who are also requested to comment on them for the information of the Naval Ship Systems Command.

Alterations involving material under the technical cognizance of the Naval Ship Systems Command are known as ShipAlts. ShipAlts can be approved by the Naval Ship Systems Command when the alterations do not affect military characteristics of the ships concerned. A ShipAlt that affects military characteristics requires approval by CNO. Any ShipAlt that requires the approval of CNO is called a NavAlt. Alterations under the technical cognizance of the Naval Ship Systems Command, regardless of whether or not they affect the military characteristics of ships, are known as ShipAlts. Thus, an alteration might be only a ShipAlt or both a ShipAlt and a NavAlt.

When the Naval Ship Systems Command determines that a ShipAlt affects the military characteristics of the ship, the alteration is forwarded to CNO. In approving NavAlts, CNO also establishes the relative priority for their accomplishment. The NavAlts are then recorded in the Ship Improvement Guide (SIG) for overall and long-range planning purposes and in the Material Improvement Plan. NavAlts are classified by CNO as follows:

Priority 1—Mandatory for national security.
Priority 2—Essential for combat readiness.
Priority 3—Desirable for naval efficiency.

An ordinary ShipAlt (a ShipAlt that does not affect military characteristics) may be approved by the Naval Ship Systems Command after all factors have been considered, including the effect of the change on weight, stability, space, power, and the possible increased effectiveness of the ship. Following approval, the relative priority of accomplishment of the ShipAlt is established. Priorities assigned to ordinary ShipAlts are:

Priority A—Mandatory.
Priority B—Essential.
Priority C—Desirable.

ShipAlts not affecting military characteristics of a ship are those ShipAlts that, in general, concern matters of safety, efficiency, and economy of operation or maintenance. Annually, the Naval Ship Systems Command compiles and issues a ship-type priority list of all ordinary ShipAlts. The ShipAlts are grouped so that those of approximately equal importance fall into the same priority groups regardless of the type ship. The ShipAlt priority lists are revised and reissued as necessary during the year.

Approval of a ShipAlt is usually evidenced by its issuance, or by a letter, to be followed by issuance of the ShipAlt, to the activities immediately concerned. Type commanders periodically review approved ShipAlts and initiate action to CNO or the Naval Ship Systems Command (as appropriate) for cancellation of those no longer considered necessary.

A ShipAlt may not be accomplished in any ship until its accomplishment has been specifically authorized by the Naval Ship Systems Command. The Naval Ship Systems Command reviews the outstanding ShipAlts for each ship in advance of regular overhauls. ShipAlts to be accomplished are selected from the Material Improvement Plan and the priority list, with due consideration being given to relative priorities and to current budgetary or fiscal limitations. The ShipAlts to be accomplished are authorized by letters issued not less than 150 days prior to the scheduled commencement of the ship's overhaul.

After study of a request for an alteration, the Naval Ship Systems Command may determine that the alteration is an alteration equivalent to a repair. An alteration that has been designated an alteration equivalent to a repair is forwarded to the appropriate type commander for accomplishment as a repair.

An alteration is considered to be an alteration equivalent to a repair if it meets one or more of the following conditions:

1. The substitution, without other change in design, of materials which have previously been approved for similar use and which are available from standard stock.
2. The replacement of wornout or damaged parts, assemblies, or equipments requiring renewal by those of later and more efficient design previously approved.
3. The strengthening of parts that require repair or replacement in order to improve reliability of the parts and of the unit, provided no other change in design is involved.
4. Minor modifications which involve no significant changes in design or functioning of equipment but which are considered essential to prevent recurrence of unsatisfactory conditions.

SHIP'S FORCE MAINTENANCE AND REPAIRS

Each ship should, insofar as practicable, be self-sustaining with regard to normal repairs. Each ship should be well supplied with materials, repair parts, and tools and equipment so that much of its own repair work can be accomplished by ship's force. Repairs should be undertaken under the supervision of the most competent and experienced personnel. Personnel not familiar with specific repairs and tests should be instructed to take advantage of shipyard or repair ship availabilities or tender assignments to observe how such work is undertaken.

The purpose of preventive maintenance is to maintain satisfactory material conditions and ensure that the equipment or machinery is always ready for service. A regular schedule of cleaning, inspections, operations, and tests is required to ensure trouble-free operation and the detection of incipient faults before they develop sufficiently to be major sources of difficulty.

Most routine inspections and tests are performed by ship's force. Some of these inspections and tests are quite simple; others require planning so that they can be undertaken during upkeep or overhaul periods. Shipyard and repair ship assistance should not be requested unless the test or inspection is actually beyond the capacity of ship's force.

An interdepartment routine request for work requiring assistance by another shipboard department is referred to as a ship's memorandum work request. Such a form enforces proper channeling of a work request between departments, and permits the setting up of priorities of available manpower and facilities. The work request memorandum is a form which is made up by the ship; however, some ships use the Repair Record, or the repair work request for this purpose. If the ship is under MDCS, the 4700.2D Deferred Action Form should be utilized to request interdepartment work vice the ship's memorandum work request.

REPAIR SHIPS AND TENDERS

In order to provide adequate facilities for unusual repair requirements and to meet varying operational commitments, particularly of ships deployed outside the continental United States, the ship assignments to the various repair activities afloat are flexible. The final assignment is usually made by message, designating the activity and the period and type of availability. These assignments are made by either the fleet or type commander.

Ships are scheduled for a regular tender availability or an upkeep period alongside repair ships or tenders at certain intervals of time which vary with different types of ships. The availability periods, which are usually planned far in advance, depend upon the quarterly employment schedule of the ship concerned.

When a ship receives its employment schedule, or is otherwise notified, it can begin to prepare the necessary paperwork in advance of the scheduled availability period. The Maintenance Deferred Action Sheet (replacement for the CSMP cards) is used as a basis for advance preparation of a work request. Work Requests (OPNAV 4700-2C) are made out on outstanding work indicated by the Deferred Action Sheet (OPNAV 4700-2D).

The work requests, with the required number of copies, are sent with a forwarding letter to the type commander or his authorized representative. The staff officer handling material and maintenance screens the work requests. Most of the ship's availability work list items are approved and authorized. Also, the ship may have to furnish more detailed information on certain work requests. The amount of corrective action taken by the reviewing staff officer will depend upon how well the work requests are written and the extent to which they follow established policies and procedures. Upon the completion of this screening, the ship's work requests are forwarded to the repair ship or tender. This is done well in advance of the assigned period of availability so that the repair department personnel can schedule the work and make any necessary preparations.

Arrival Conference

When a ship comes alongside for a regular tender availability or an upkeep period, an arrival repair conference is usually held immediately. The conference is attended by representatives of the ship, of the repair department, and (usually) of the type commander. The relative needs of the ship and the urgency of each job are discussed. The arrival repair conference serves to clarify all uncertainties for repair department personnel who have received and studied the work requests in advance.

Arrangements are also made for the repair ship to provide the primary services of steam and electricity in sufficient quantity to take care of heating and lighting requirements and to provide limited power for ships alongside. In addition to these services, the repair ship may take over communication watches. Fresh water and fuel requirements are not usually supplied except from barges.

The repair department in a repair ship or tender functions to effect repairs in a manner similar to that of a production department in a naval shipyard, even to the extent of assigning ship superintendents as representatives of the repair officer. The organization of the production department and the duties of the ship superintendent of the naval shipyard will be discussed later in this chapter.

Work Requests and Job Orders

Although the terms "work request" and "job order" are sometimes used interchangeably, this is not technically correct because the two terms actually have slightly different meanings. Work requests are made up by the ship and are forwarded through proper channels to the repair activity. When the work request has been approved by the repair activity, it is issued as a job order.

As soon as the work requests have been approved at the arrival conference, the jobs that require delivery to the tender should be started. Starting these repair jobs early is very important in getting all necessary jobs completed. Equipment that is not needed for the operation of the ship may be disassembled in advance so that the defective parts can be delivered to the tender as soon as the work requests have been approved.

All material delivered to the tender must be properly tagged and identified. The information on each tag should include the number and name of the ship; the department, division, or space; and the job order number. Additional information should be included if necessary. Reference material such as blueprints and manufacturers' technical manuals should be identified with the ship's name and number.

Ship-to-Shop Jobs

Many repair jobs are designated by the ship or approved by the repair activity as "ship-to-shop" jobs. In a job of this type, ship's force does a large part of the repair work. For example, the repair or renewal of a damaged pump shaft might well be written up as a ship-to-shop job. The pump is disassembled and the shaft is removed by ship's force; the shaft and any necessary blueprints are delivered to the machine shop of the repair activity. The machine shop supervisor checks the job and gives an approximate date of completion. When the shaft has been repaired, or when a new one has been made, it is picked up and brought back to the ship by ship's force. The pump is reassembled, inspected, and tested by ship's force to ascertain that the unit is satisfactory.

Repair jobs on portable equipment such as small gages and valves are almost always written up as ship-to-shop jobs.

Checking Progress of Tender Repair Jobs

Tender repairs that are being accomplished on a ship can be checked by discussing them with the petty officer in charge of the repair detail. The petty officer in charge should know at all times the status of repair work (including ship's force repair work) being done for his space or equipment. Checking on the progress of work in the shops on the tender requires planning and coordination between the ship and the tender. Personnel in the tender shops are busy with their repair work, so any method used to check on progress of work must be one which does not interfere with progress.

Some tenders and repair ships have a chief petty officer who acts as ship superintendent. His duties include:

1. Acting as liaison officer between the ships alongside and the tender in regard to repair department jobs.
2. Acting as a coordinator of shop work for assigned ships.
3. Reporting daily to a representative of the ship.

4. Maintaining a daily running progress report or chart which indicates the percentage of completion of each job; the availability of plans, manufacturers' technical manuals, samples, etc.; and the availability of materials required for each job. Repair ships with computer systems generally print out on the average of three times a week a status of work in the repair shops for customer ships.

5. Notifying the ship when it is time to pick up completed work from the tender.
6. Notifying ship's personnel when it is necessary for them to witness tests needed because work has been performed on machinery, compartments, and tanks.

7. Obtaining signatures from officers if job orders are cancelled or changed.

If the tender provides a ship superintendent, it is obviously quite easy for ship's personnel to check on the progress of the work. If the services of a ship superintendent are not provided, the ship alongside the tender generally appoints a petty officer to perform similar duties for the division or department.

A progress chart should be kept for all work that is planned for accomplishment during the repair period. The chart should be kept up to date with respect to the status of each job. Keeping a close watch on the progress of the repair work will ensure that jobs are not unnecessarily delayed, that jobs are not overlooked or forgotten, and that all work undertaken is satisfactorily completed at the end of the repair period.

Repair ships with computer systems will provide the customer ships with a copy of the print out pertaining to the jobs that the ship submitted for accomplishment. This print out will give the status of the work and can be effectively used as a progress chart.

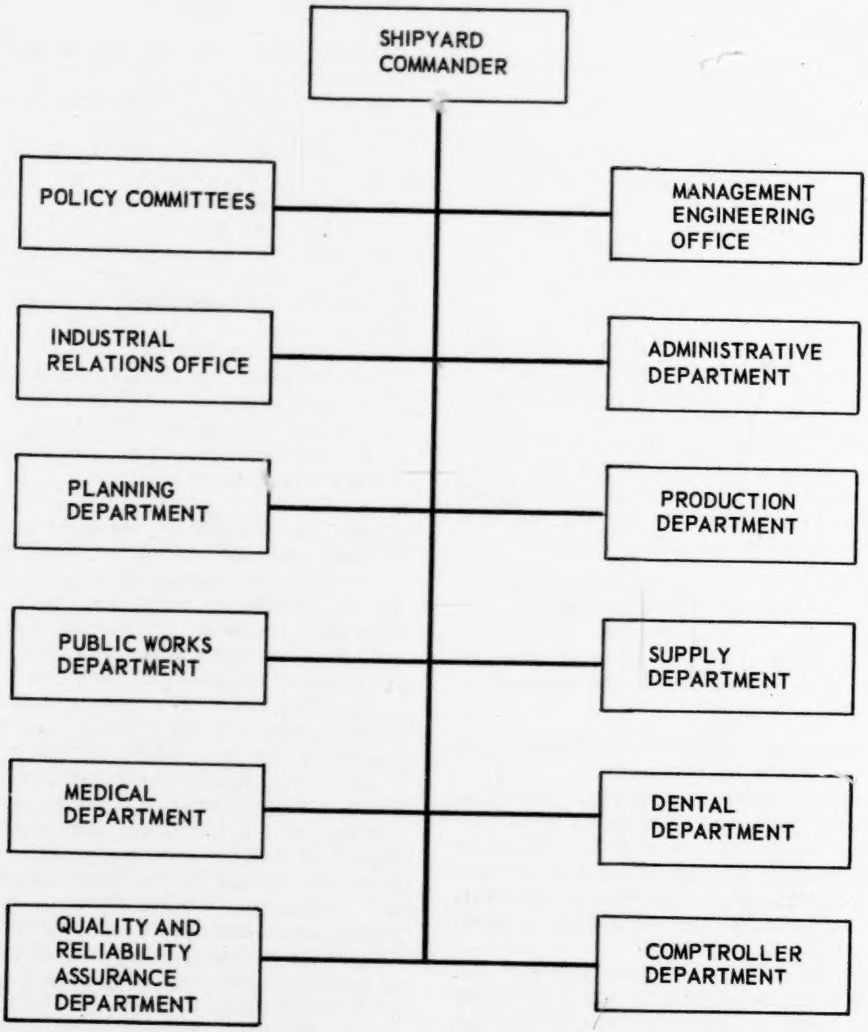
NAVAL SHIPYARDS

Naval shipyards under the management control and technical direction of the Naval Ship Systems Command are operated to perform the following tasks and functions:

1. Provide logistic support to activities and units of the active fleet of the U.S. Navy and the naval shore establishment.
2. Perform authorized shipwork in connection with the new construction, conversion, overhaul, repair, alteration, activation, inactivation, and outfitting of naval ships and service craft.
3. Design naval ships.
4. Operate as planning yards for ship alterations and prepare allowance lists for ships under construction and conversion.
5. Perform research, development, test, and evaluation work assigned.
6. Serve as primary and secondary stock points for designated material controlled by bureaus and offices of the Navy Department.
7. Provide accounting, civil payroll, public works, industrial relations, medical, dental, berthing, messing, fire protection, security, and other services of naval activities and other government agencies, as assigned.
8. Perform work for other U.S. Government departments, private parties, and foreign governments, as directed by competent authority.

Shipyard management comprises all elements of administration from the shipyard commander to the individual who is charged with supervision of the smallest group. The management is charged by the Navy Department with the complete administration, coordination, management, operation, and technical control of all phases of naval shipyard activity. The line of authority and control passes from the shipyard commander through the heads of departments, divisions, and offices to the administrative units. Additional information concerning administration, as well as organization, of naval shipyards, can be obtained from U. S. Navy Regulations and Navy Department directives. The organization of a typical U. S. naval shipyard is illustrated in figure 10-1. The two departments with which the engineer officer will be most concerned are the planning department and the production department. The production department contains the shops that accomplish the repair work on the ship.

The first specific knowledge of the work to be undertaken by the naval shipyard on an


SHIPYARD COMMANDER
POLICY COMMITTEES
MANAGEMENT ENGINEERING OFFICE
INDUSTRIAL RELATIONS OFFICE
ADMINISTRATIVE DEPARTMENT
PLANNING DEPARTMENT
PRODUCTION DEPARTMENT
PUBLIC WORKS DEPARTMENT
SUPPLY DEPARTMENT
MEDICAL DEPARTMENT
DENTAL DEPARTMENT
QUALITY AND RELIABILITY ASSURANCE DEPARTMENT
COMPTROLLER DEPARTMENT

63.11

Figure 10-1.—Organization of a typical Naval Shipyard.

overhaul begins with the arrival in the planning department of the shipyard of NAVSHIPS 150-day letter which lists the alterations that are to be accomplished. The letter also includes a funds grant for the accomplishment of the alterations.

Prior to the scheduled commencement of the overhaul of a ship, the planning department of the naval shipyard generally receives a copy of the ship's worklist (with type commander's action) in the form of a booklet of work requests accompanied by a funds grant for undertaking as many repairs as possible within the funds limitations. Preliminary estimates are developed and sent to the production department where the production engineering division uses the estimates for scheduling and workload purposes. Next, the planning department prepares requisitions for material requiring long lead time, and issues a preliminary work booklet for repairs.

Whenever possible, a naval shipyard will send representatives from the planning department and, in some cases, from the production department to inspect the ship prior to its arrival at the shipyard for a regular overhaul. The pre-arrival inspection affords the shipyard personnel an opportunity to check plans against the ship in order to determine their applicability; determine what design services, specifications or changes are necessary; determine the special material that will be required; discover any unusual problems that may be encountered; check jobs to determine whether preliminary estimates are in consonance with the actual work to be performed; and conduct a pre-arrival conference with the ship's officers and the type commander's representative.

After the pre-arrival inspection or, in the event that it is impossible to conduct such an inspection, as soon as firm information is available, the planning department begins preparation of job orders. After writing the job order instructions, the department prepares a material list showing, by key operation, the quantity, source, stock number, and delivery point of the material required. If shop stores material is not itemized, the planner enters a budget figure (in dollars) for the shop stores material which he expects the key shop to expend on each key operation. Then, the job order and material list are sent to the production department where the production engineering division adds key operation dates and material required dates (MRD).

As work proceeds on the overhaul of the ship, it may be necessary to issue further information or instructions that were not practicable to include or the need for which was not foreseeable at the time of original issuance. If so, a job order supplement is issued under the original job order number. Its preparation and issuance are identical to that of a job order. The use of job order supplements is restricted as much as practicable; they are not used to revise man-hour allowances, unless the scope of the work is changed.

The planning department prepares allowance lists (lists of equipment components, repair parts, or material necessary for proper operation, maintenance, and repair of the ship for specified periods of time) for newly constructed ships, and corrects existing allowance lists for ships for which the shipyard is the home yard. Plans, material requisitions, or job orders pertinent to the ship's equipment are the sources from which the necessary information is obtained to prepare or correct the COSAL. It is necessary to reflect removals as well as additions or replacements of equipment. Information on each item listed is given in sufficient detail to identify and reorder.

As directed by job order, the design division of the planning department issues procedures for carrying out tests of equipment and work. The description of the procedures includes a listing of special measures to be followed, safety precautions to be observed, and an outline of the nature and form of the report to be made. After the conducting of the test by the production department, data is turned in and the complete report of the test is formulated.

At commencement of an overhaul, the engineer officer must deliver the master and one other copy of the ship's Damage Control Book to the superintendent of the design division of the planning department. The design superintendent is notified by the production department and the engineer officer, of changes accomplished during the overhaul that affect damage control installations. Appropriate corrections are made, the master copy is forwarded to the Naval Ship Systems Command, and the other copy is returned to the ship. The Naval Ship Systems Command accomplishes any required reprinting of the ship's Damage Control Book and returns the master copy to the ship with extra copies of corrections for insertion in other copies of the book.

Shops

A shop in a naval shipyard is a unit assigned certain specific work, usually by trades, and manned with specially trained and qualified men adept in the type of work assigned. The shop usually performs its peculiar type of work for the entire yard. Most of the shops are assigned to the production department. (Transportation, shop 02, and the power plant, shop 03, are assigned to the public works department.) All production department shops are under the supervision of the production officer. Each shop group is under the control of a civilian group superintendent.

A typical production department shop group organization is shown in figure 10-2. Each shop

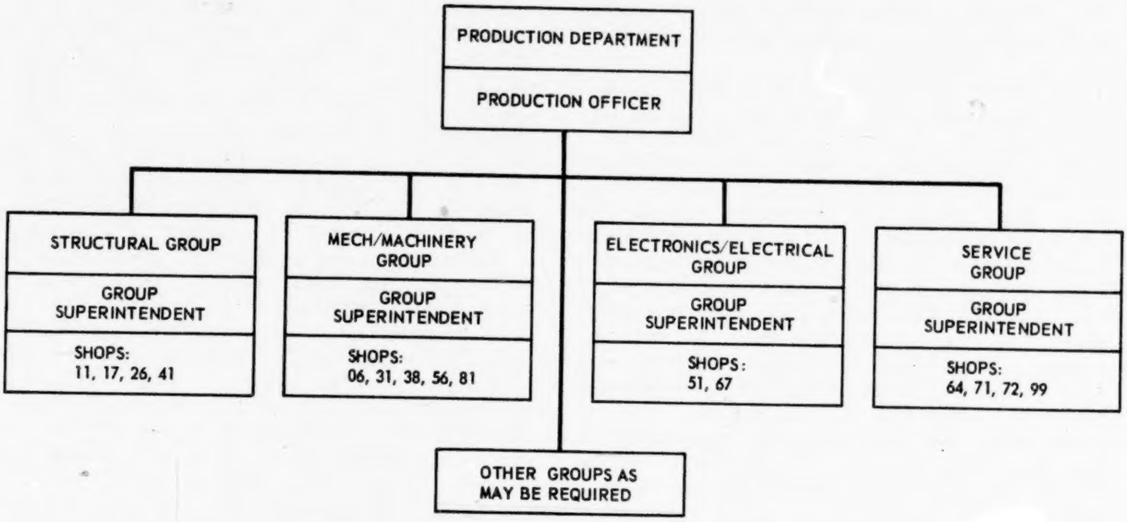

PRODUCTION DEPARTMENT
PRODUCTION OFFICER
STRUCTURAL GROUP
GROUP SUPERINTENDENT
SHOPS: 11, 17, 26, 41
MECH/MACHINERY GROUP
GROUP SUPERINTENDENT
SHOPS: 06, 31, 38, 56, 81
ELECTRONICS/ELECTRICAL GROUP
GROUP SUPERINTENDENT
SHOPS: 51, 67
SERVICE GROUP
GROUP SUPERINTENDENT
SHOPS: 64, 71, 72, 99
OTHER GROUPS AS MAY BE REQUIRED

Figure 10-2.—Shop group organization of the production department.

64.16A

is assigned a number and a name. Certain shops are not located in some shipyards; some shops, however, are common to all shipyards. At some shipyards, certain shops may be combined with another shop. The following is a list of production department shops, by number and name, common to all naval shipyards:

06	Central Tool
11	Shipfitters Shop
17	Sheet Metal Shop
26	Welding Shop
31	Inside Machine Shop
38	Outside Machine Shop
51	Electric Shop
56	Pipe and Copper Shop
64	Woodworking Shop (may include shop 94, Pattern Shop, in some shipyards)
67	Electronics Shop
71	Paint Shop
72	Riggers and Laborers Shop (may include shop 74, Sail Loft, in some shipyards)
74	Sail Loft
99	Temporary Service Shop

The following is a list of production department shops, by number and name, located only in certain shipyards:

23	Forge Shop
25	Gas Manufacturing Shop
27	Galvanizing Shop
35	Optical Shop
36	Weapons Shop
37	Electrical Manufacturing Shop
41	Boiler Shop
68	Boat Shop
81	Foundry
94	Pattern Shop
97	Ropewalk

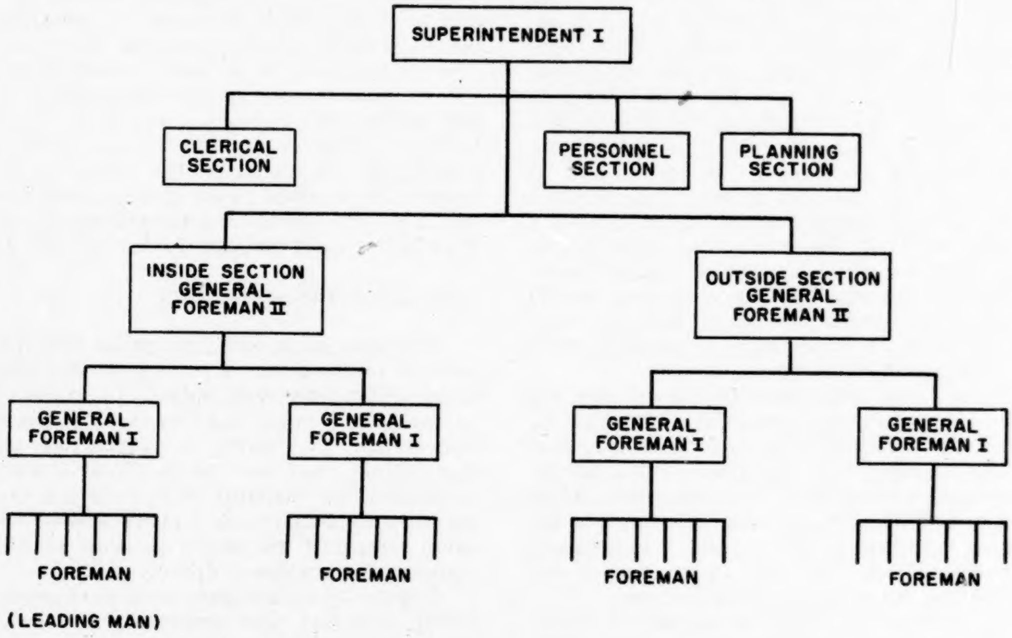
Each shop in the production department is assigned to a shop group consisting of one or more shops. The shop group superintendent, in charge of each shop group, is responsible to the production officer for (1) the organization and administration of his shop group and of the shops within the group; (2) the training and supervision of the personnel assigned; (3) the coordination and overall guidance of the work of the shops within the group, aimed at orderly progress, timely and economical job completion, and effective use of manpower in conformance with safe practices and job specifications; and (4) the maintenance of good order, cleanliness, and discipline in the spaces used.

A superintendent (Superintendent I) is in charge of each production department shop. He is responsible to the shop group superintendent for the organization and administration of the shop. The superintendent (I) is assigned clerical, administrative, and technical assistants as necessary to ensure: (1) effective use of manpower; (2) conformance with safe work practices and job specifications, (3) orderly progress and timely completion of job orders; and (4) proper maintenance of personnel and shop records. The organization of a typical shop in the production department is shown in figure 10-3.

The Ship Superintendent

The ship superintendent is the representative of the production officer and one of his principal assistants in coordinating, arranging, and accomplishing authorized work on a ship during its availability in the shipyard.

It is customary to assign a ship superintendent a considerable period in advance of the ship's arrival in the yard. During the interval before arrival, considerable study and assembly of data are required. The ship superintendent obtains a copy of the departure report for the last availability of the ship in the shipyard and copies of all outstanding job orders issued on the ship. From a study of these, he obtains a familiarity with the current jobs. If his study indicates that certain jobs were not completed during the previous overhaul because of late delivery of certain items of material, the ship superintendent immediately starts checking on the status of delivery of the material, to ensure its availibility. From the assistant planning and estimating superintendent he obtains information on the time and place the arrival conference will be held. He reviews the lists of proposed work and obtains a list of the civilian planners and estimators who are to be assigned to the ship. He ascertains from the shipyard watch officer the time of the ship's arrival and the berth to which it is assigned. From the design division of the planning department he may obtain a booklet of plans, which he utilizes to familiarize himself with the general arrangements of the ship. From each shop concerned with the work to be done, he obtains the names of the civilian supervisors who will be assigned to the ship, and in turn notifies them of the ship's pending arrival and of any jobs requiring special attention or


SUPERINTENDENT I
CLERICAL SECTION
PERSONNEL SECTION
PLANNING SECTION
INSIDE SECTION GENERAL FOREMAN II
OUTSIDE SECTION GENERAL FOREMAN II
GENERAL FOREMAN I
GENERAL FOREMAN I
GENERAL FOREMAN I
GENERAL FOREMAN I
FOREMAN
FOREMAN
FOREMAN
FOREMAN
(LEADING MAN)

64.16B

Figure 10-3.—Organization of a typical production department shop.

immediate action. Preliminary discussions on lengthy or complex jobs will permit everyone involved to obtain a clear understanding of the desired course of procedure so that valuable time will not be lost once the work is started.

From 18 to 24 hours prior to the arrival of the ship in the yard, the ship superintendent sees that the service shops are informed of the berth assigned and the time of arrival. Shop 72 furnishes riggers for the placement of the brow; and shop 90 (temporary service) provides for steam, water, and air connections, shore power, and telephones.

The ship superintendent is at the dock when the ship arrives and ties up, and checks to make certain that the required services are promptly furnished. (The ship superintendent is one of the first contacts the ship has with yard personnel and throughout the overhaul is, in fact, the liaison with the yard.) Upon first going aboard the ship, he delivers to the commanding officer, or in his absence the executive officer, copies of orders and regulations which outline and specify procedures on points mutually affecting the shipyard and the ship.

Among the subjects covered are: (1) the appointment of ship inspectors for the overhaul, (2) the requirement for fire watches for various types of work, and (3) general shipyard information for ships. As soon as the ship's force is secured from the mooring maneuver, the ship superintendent requests a meeting with the heads of departments. At the meeting the ship is (1) notified of the time and place of the arrival conference, (2) advised of the urgent necessity for fire watches, the basic organization and duties of fire watches, and the place and manner of obtaining portable fire extinguishers, and (3) requested to furnish a suitable place on board ship to serve as a ship superintendent's office for the duration of the overhaul.

If the ship superintendent finds that the work required on any given job order may be performed in a better way or at a cheaper cost than as required in the original specifications, he prepares an additional work request outlining the recommended change and submits it to the planning department. If adopted, it is formally promulgated as a job order supplement superseding the original specifications.

The shipyard commander conducts frequent (usually weekly) conferences with the commanding officer of each ship in the shipyard, to review the progress of work on the ship. The ship superintendent and other appropriate shipyard supervisory personnel also attend the conference. Because he is responsible for the production, coordination, and progress of all jobs, the ship superintendent must carefully plan the performance of work in key jobs. During the course of the overhaul, he holds frequent conferences with shop personnel, ship personnel, the assistant planning and estimating superintendent, progressmen, and other yard personnel, to ensure a timely completion of all authorized work.

Each ship undergoing overhaul assigns inspectors and representatives from each department to inspect work and witness tests, since these are a responsibility of the commanding officer as outlined in U.S. Navy Regulations. (The ship superintendent is the yard's representative for these functions.)

At least one day prior to the scheduled end of the overhaul the ship superintendent will hold a departure conference with the ship's representatives. At the conference, last-minute adjustments or corrections are discussed and agreed upon. All job orders not previously signed by the ship's representatives are signed as "completed," or "completed, subject to final test." If any work is deemed unsatisfactory, the cognizant officer records the reasons. The conference is a very important occurrence because the actual final status of all job orders is determined and it permits following up the uncompleted work on the next availability of the ship. The status of all job orders is reported to the planning department, which is responsible for the preparation of the departure report discussed later in this chapter.

Home and Planning Shipyards

The mission of naval shipyards is to render service to the fleet. To carry out this function more effectively each ship in the active fleet is assigned a home yard by the Chief of Naval Operations. Two naval shipyards (one on the East Coast, and one on the West Coast) are designated as planning shipyards for each of the various ship types. A home shipyard is the naval shipyard to which a ship is usually assigned for regular overhaul.

Regularity in assignment of work permits a better analysis and uniformity of workload. Home shipyards maintain certain basic records on assigned ships which serve as a continual source of reference. Records on outstanding job orders with the status of both physical completion and material deliveries are maintained. Finished plans and allowance lists, consisting of hull, machinery, navigation, and weapons items, are filed and maintained current. Thus, for each item of work, the time required for familiarization and investigation of details is held to a minimum, permitting more time to be devoted to actual work accomplishment.

As a further expansion on permanency of relationship between ships and naval shipyards, each class of ship has been assigned a planning shipyard. A planning shipyard undertakes the design work for the class of ship assigned it and, when authorized, procures material required by other overhauling yards for the accomplishment of work affecting all the ships of the class. It can readily be seen that with several shipyards overhauling the same class of destroyers on the east coast, an economy in the use of design manpower is gained if this work is performed in only one yard and the developed plans supplied to the others.

Work Requests

The procedures for submitting shipyard work requests prior to a regular overhaul can generally be found in U.S. Navy Regulations; they are specified in detail in regulations issued by fleet commanders and type commanders.

Type commanders require that work requests to be accomplished during an overhaul (regular or interim) be submitted, for their inspection, screening, and approval, in sufficient time to allow completion of the type commander's action and arrival of the work requests at the shipyard in advance of commencement of the overhaul; this is necessary in order to permit successful preliminary planning by the shipyard.

Each work request is submitted on the standard work request form. All work requests are screened and assigned a priority for accomplishment at a conference of the heads of department, the executive officer, and the commanding officer. A work list containing brief statements of the work to be accomplished, arranged in the ship's integrated priority sequence, is prepared and submitted along with the work requests to the type commander for his screening action. Following his screening action, the type commander forwards the approved request to the naval shipyard or SUPSHIP, as appropriate.

Alteration Requests

The list of authorized alterations that are to be accomplished at a routine naval shipyard overhaul is prepared by NavShips. NavShips usually provides the type commander with a priority list of the alterations to be accomplished on the ship scheduled for a regular overhaul approximately 150 days prior to the overhaul. The type commander submits to NavShips annually the recommended SHIPALTS to be considered for accomplishment in the ships to be overhauled during the fiscal year. NavShips publishes in the Fleet Modernization Program (FMP) the SHIPALTS that are authorized for accomplishment.

Approximately 90 days in advance of the ship's arrival, NavShips will forward to the shipyard, to the type commander, and to the ship a list of approved alterations (90 day material status letter) in the priority applicable to the individual ship. Any changes in the scope of work authorized in the 150-day letter will be reflected in this letter.

SHIPALTS marked for accomplishment by forces afloat are not, as a rule, undertaken by naval shipyards.

Obtaining Additional Repair Jobs

It may be necessary to prepare supplementary work requests to include items arising after the submission of the original work requests. Additional repairs may be required because of voyage casualties or because of conditions discovered during shipyard tests and inspections. The supplementary work requests must be submitted in accordance with the same procedure used for submitting the original work requests, and the supplementary items must be dovetailed into the ship's priority index.

Supplementary work requests should be made out immediately, as soon as the need becomes evident, and submitted to the yard as soon as possible after they have been prepared.

THE SUPERVISOR OF SHIPBUILDING

An office of the Supervisor of Shipbuilding, under the management control of the Naval Ship Systems Command and military control of the District Commandant, is established in each Naval District. The Supervisor of Shipbuilding heads the Office of the Supervisor of

Shipbuilding and is responsible for the following:

1. Awarding and administering repairs, alterations, conversions, activations, and inactivations of naval ships performed by private shipyards under NavShips Master Ship Repair (MSR) contracts.
2. Allocating unscheduled overhauls between naval and private shipyards.
3. Supervising the installation of weapons equipment on merchant ships at private shipyards.
4. Installing and maintaining shore-based electronics and weapons equipment.
5. Carrying out duties, as directed by NavShips, in marine salvage operations within the district.
6. Coordinating industrial mobilization planning with respect to shipbuilding, conversion, and repair.

Organization of the Office of the Supervisor of Shipbuilding

In naval districts where a naval shipyard is located, the shipyard commander may also be a Supervisor of Shipbuilding. Where the shipyard commander is the Supervisor of Shipbuilding, the Supervisor of Shipbuilding Assistant, normally the planning officer of the shipyard, serves as the administrative head of the Office of the Supervisor of Shipbuilding. The standard organization for the Office of the Supervisor of Shipbuilding (SUPSHIPS) is shown in figure 10-4.

The department of the Office of SUPSHIP with which the engineer officer will be most concerned is the planning department. The planning officer is head of the ship repair department. The planning department (discussed in the next section) consists of the planning and estimating division and the design division; and provides planning and design services for the performance of all overhaul and repair work under SUPSHIP cognizance.

When the volume and location of the workload indicates that the MSR Contract can be more effectively and economically administered through decentralized operations, the Secretary of the Navy may establish more than one Office of the Supervisor of Shipbuilding in a naval district.

SUPSHIPS is authorized to establish and disestablish resident SUPSHIP offices at localities where circumstances warrant the performance of certain clerical, planning contractual or coordinating functions adjacent to work sites. A Resident SUPSHIP office is an informally established component of the parent SUPSHIP. The Resident SUPSHIP office organization parallels the standard organization of SUPSHIP to the extent necessary to ensure efficient performance of assigned duties. The cognizant SUPSHIP may authorize a Resident SUPSHIP to deal directly with the fleet, bureaus and offices of the Navy Department, and contractors on matters pertaining to assigned duties.

In order to perform inspections and related clerical functions that can be more effectively carried out at or near work sites, SUPSHIPS establishes offices such as Resident Inspection Offices, as necessary, at or near private shipyards. Resident Inspection Offices function under the direction of the inspection department of the Supervisor of Shipbuilding, and provide ship surveyors for inspecting local work.

Functions of Typical Departments

The sections which follow deal with the major functions of typical departments of a SUPSHIP organization shown in figure 10-4.

THE ADMINISTRATIVE DEPARTMENT.—The ADMINISTRATIVE DEPARTMENT serves the SUPSHIP in matters concerning naval and civilian personnel, industrial relations, public relations, and office services. The two divisions of the administrative department are the CIVILIAN PERSONNEL DIVISION and the ADMINISTRATIVE SERVICES DIVISION.

The functions of the civilian personnel division (through the ADMINISTRATIVE OFFICER who is responsible to SUPSHIP) include the organization, supervision, and administration of the department, establishment of procedures respecting both internal and industrial security administration for the SUPSHIP organization, performance of necessary public relations functions concerning prepared statements, information releases, inquiries from the local press, and launchings in accordance with instructions from SUPSHIP.

The CIVILIAN PERSONNEL OFFICER administers civilian personnel matters in accordance with Naval Civilian Personnel Instructions (NCPI), the Federal Personnel Manual, and other pertinent directives. He also keeps the SUPSHIP informed of instructions and

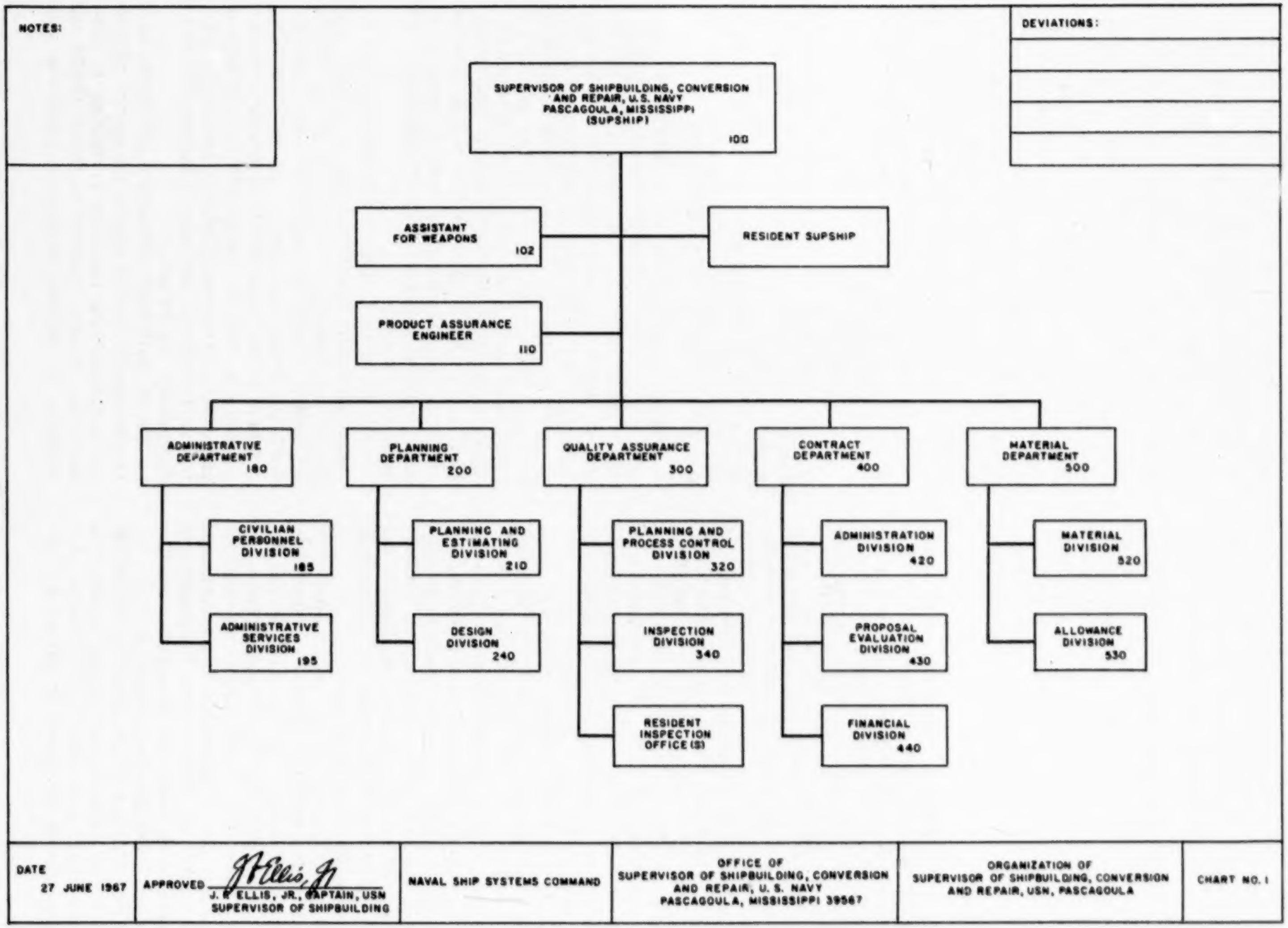

NOTES:
DEVIATIONS:
SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR, U.S. NAVY PASCAGOULA, MISSISSIPPI (SUPSHIP) 100
ASSISTANT FOR WEAPONS 102
RESIDENT SUPSHIP
PRODUCT ASSURANCE ENGINEER 110
ADMINISTRATIVE DEPARTMENT 180
PLANNING DEPARTMENT 200
QUALITY ASSURANCE DEPARTMENT 300
CONTRACT DEPARTMENT 400
MATERIAL DEPARTMENT 500
CIVILIAN PERSONNEL DIVISION 185
ADMINISTRATIVE SERVICES DIVISION 195
PLANNING AND ESTIMATING DIVISION 210
DESIGN DIVISION 240
PLANNING AND PROCESS CONTROL DIVISION 320
INSPECTION DIVISION 340
RESIDENT INSPECTION OFFICE(S)
ADMINISTRATION DIVISION 420
PROPOSAL EVALUATION DIVISION 430
FINANCIAL DIVISION 440
MATERIAL DIVISION 520
ALLOWANCE DIVISION 530
DATE 27 JUNE 1967
APPROVED J. F. Ellis, Jr.
J. F. ELLIS, JR., CAPTAIN, USN SUPERVISOR OF SHIPBUILDING
NAVAL SHIP SYSTEMS COMMAND
OFFICE OF SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR, U. S. NAVY PASCAGOULA, MISSISSIPPI 39567
ORGANIZATION OF SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR, USN, PASCAGOULA
CHART NO. 1

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Figure 10-4.—Organization chart of the office of the SUPERVISOR of SHIPBUILDING.

policies of the Navy Department and other government agencies relating to local labor conditions, and provides contractors with any useful information which may promote industrial health and safety.

The ADMINISTRATIVE SERVICES SUPERINTENDENT (Administrative Services Division) is responsible for providing complete office services for the operation of the SUPSHIP office, recording, distributing, and controlling classified matter within the SUPSHIP office, and administering civilian payroll and maintaining fiscal budgets and records in accordance with NAVSHIP S instructions.

THE PLANNING DEPARTMENT.—The PLANNING DEPARTMENT, responsible to the SUPSHIP for the organization, administration, and supervision of the department, consists of two divisions; the PLANNING and ESTIMATING DIVISION and the DESIGN DIVISION.

The PLANNING OFFICER, who maintains liaison between the planning department, contractors, and other naval activities with whom the SUPSHIP works, provides work planning and design services required for the administration of contracts under the cognizance of the SUPSHIP, particularly on technical problems involving joint responsibility. This ensures that there is an effective flow of technical information and the design schedule requirements conform to ship construction schedules.

An ASSISTANT PLANNING OFFICER (staffed only when new construction workload exits) is responsible to the planning officer for the technical and administrative management of assigned department functions as related to submarine or surface new construction as appropriate. He also acts as planning officer, when required, and assumes the additional duties and responsibilites of planning and estimating officer when the billet is activated.

A PLANNING ASSISTANT, also staffed when new construction workload exists, is responsible to the planning officer for the coordination and monitoring of planning department actions, as well as taking the initial action on contract changes, for new construction ships assigned. He also acts as liaison with headquarter's and contractor's personnel to expedite resolution of design and planning problems.

The PLANNING and ESTIMATING OFFICER (Staffed in the planning and estimating division only when repair or conversion workload exists) is responsible to the planning officer for the organization, administration, and supervision of the planning and estimating division.

The HEAD DESIGN ENGINEER is responsible to the planning officer for the organization, administration, and supervision of the design division. He provides engineering advice and technical design services dealing with construction, conversion, and repair of ships. He reviews contractor's design work, manufacturers' plans, technicial manuals, and test memoranda for conformance with the intent of prime contract. He evaluates and approves contractor's plans, purchase orders, technical manuals and information, and maintains liaison with design agents, contractors, and other activities with whom exchange of technical information is necessary. In addition, he establishes and administers the Value Engineering and the Weight Control programs of the office.

THE QUALITY ASSURANCE DEPARTMENT.—The QUALITY ASSURANCE DEPARTMENT consists of the following divisions or offices: (1) PLANNING and PROCESS CONTROL DIVISION, (2) INSPECTION DIVISION, and (3) RESIDENT INSPECTION OFFICE(S).

The QUALITY ASSURANCE OFFICER is responsible to the SUPSHIPS for the organization, administration, and supervision of the quality assurance department. He is also responsible for determining physical progress of work, reviewing the contractor's systems for the control of quality in the production phase (and submitting data to the product assurance engineer for evaluation), inspection, final acceptance testing, trials and deliveries of work under contract to ensure compliance with approved plans, contract specifications, and completion dates.

The SURFACE SHIP COORDINATOR is responsible to the quality assurance officer for the accomplishment of functions of that office pertaining to surface ships. He acts for SUPSHIP to coordinate responsibilities of all departments in preparation for sea trials and presenting ships to INSURV, ensures that all production preparation is accomplished for launching, docking, and inclining, and effects liaison with precommissioning details.

The SUBMARINE PROJECT OFFICER, who is responsible to the quality assurance officer for accomplishing functions pertaining to submarines, reports directly to the SUPSHIP on matters concerning submarine progress and certification. He serves as chairman of the submarine certification committee and as radiological protection officer for the SUPSHIP. The other functions are similar to those of the Surface Ship Coordinator, discussed previously.

The PLANNING and PROCESS CONTROL DIVISION is responsible to the quality assurance officer for preparing department programs and inspection schedules, monitoring audit plans for the department, coordinating test memorandum review, reviewing and approving procedures for welding, brazing, and non-destructive testing processes, and conducting training of personnel in non-destructive training.

The INSPECTION DIVISION, also responsible to the quality assurance officer, witnesses inspections and tests as required, performs surveillance of the contractor's quality assurance program, reports inspection data for analysis, provides services to the department on areas concerning blueprint files, test calls, and reports, and assembles information concerning the current status of all work assigned to SUPSHIP.

THE CONTRACT DEPARTMENT.—The CONTRACT OFFICER is responsible to the SUPSHIP for the organization, administration and supervision of the CONTRACT DEPARTMENT. The department divisions are the (1) ADMINISTRATION DIVISION, (2) PROPOSAL EVALUATION DIVISION, and the (3) FINANCIAL DIVISION.

The contract officer is responsible for acting on all contractual, accounting, and financial matters relating to prime contracts, awarding and administering all Master Ship Repair contracts and job orders placed thereunder for repair and overhaul work, and timely review, analysis, negotiation, issuance, and adjudication of all changes to assigned contracts.

The ASSISTANT CONTRACT OFFICER, who acts as the contract officer during his absence, is responsible to the contract officer for continuous administration of all non-technical aspects of contracts.

The CONTRACT ADMINISTRATION DIVISION is responsible to the assistant contract officer for accomplishing related functions such as reviewing and consenting to subcontracts requiring business reviews, preparing and assembling final settlement documents, accomplishing all procurements for repair and overhaul services under the Master Ship Repair contract, and administering job order terminations.

The PROPOSAL EVALUATION DIVISION is responsible to the assistant contract officer for coordinating the overall SUPSHIP effort in the processing of changes and requests for changes including specific functions such as (1) developing a preliminary cost estimate for obligation purposes, (2) developing an independent estimate, as required, for pricing purposes, (3) preparing Technical Advisory Reports (TAR'S), and (4) assembling all data required by the negotiatior.

The FINANCIAL DIVISION is responsible to the assistant contract officer for the following functions: certifying vouchers for payment and maintaining records and accounting for shipwork funds allocated to SUPSHIP.

THE MATERIAL DEPARTMENT.—The MATERIAL OFFICER is responsible to the SUPSHIP for the organization, administration, and supervision of the MATERIAL DEPARTMENT, and for performing the following functions: (1) controlling and expediting delivery of government furnished material, (2) property administration, (3) preparing and maintaining allowance lists, (4) conducting pre-award surveys, (5) receiving and disposing of government furnished material, and (6) administering facilities contracts.

The ASSISTANT MATERIAL OFFICER, who acts as material officer during his absence, is responsible to the material officer for continuous administration of the assigned material department functions.

The MATERIAL DIVISION is responsible to the assistant material officer for accomplishing functions dealing with controlled material requirements, allotments and priority designations, assisting shipbuilders in obtaining delivery of contractor furnished material, as required, preparing, reviewing, and processing requisitions to Navy Supply activities for government furnished material and equipment, and maintaining close cooperation with material disposal agencies.

The ALLOWANCE DIVISION is responsible to the assistant material officer for accomplishing the following functions: preparing and maintaining individual ship's allowance lists for new construction or conversion; preparing and processing changes to the allowance list resulting from shipwork performed during repair, provisioning documentation, and maintaining liaison with the material division with respect to procuring and assembling on-board repair parts, as required.

SUPSHIP Procedures

As far as the ship is concerned, there is not much difference between procedures during overhaul at a private shipyard and overhaul at a naval shipyard. Some differences will be noticeable, however. Three or four months prior to the commencement of the ship's regular overhaul, SUPSHIP sends a letter to the ship confirming the date of commencement of the overhaul, accompanied by other basic information useful to the ship and usually in the form of an information manual for ships assigned a SUPSHIP availability.

Work requests for overhaul at a private shipyard must be submitted in time to provide SUPSHIP with original copies of the ship's work requests prior to commencement of the ship's overhaul. SUPSHIP should receive the type commander's screened copies of the work request prior to commencement of the overhaul. SUPSHIP must have job specifications ready for distribution 28 days prior to the overhaul in order to allow prospective contractors to review them before the bidders' inspection of the ship that is normally scheduled 21 days prior to overhaul. The bids are opened and the contract is awarded at least two weeks prior to start of the overhaul. SUPSHIP notifies the ship of the name and location of the shipyard as soon as possible after the contract is awarded.

The bidders inspection of the ship is scheduled to permit representatives of the various shipyards in the area to visit the ship and obtain information for use in preparation of their bids. The engineer officer of the ship should require his personnel to offer any assistance that may be needed by the representatives and to treat them all equally by allowing them access to the same spaces, records, plans, and information. In order to protect the interests of the Navy, however, no information must be given at any time to any contractor or contractor's employee regarding (1) funds available for the overhaul, (2) length of availability, (3) priority listing of repairs or alterations, (4) possible items to be deferred or canceled, and (5) variations of conditions from the information in the job order specifications or the probable extent of anticipated repairs.

After the start of an availability at a private shipyard, requests for new items of work must be submitted to the cognizant type commander for his action. The requests should be confined to essential work because this type of job order must be negotiated with the contractor (not infrequently) at a higher price than would be possible with the competitive feature of the original contract. New items of work that fall within the scope of the original job order specifications can be accomplished under a changes clause in the original specification.

Soon after the arrival of the ship at the private shipyard (normally on the second or third day following arrival), an arrival conference is held to review each work item and make any necessary revisions to the job specifications. The conference provides the ship's force with an opportunity to review the job order specifications and discuss the overhaul with SUPSHIP personnel.

Normally, the contractor's representatives do not attend the arrival conference; instead, the SUPSHIP (when it is considered necessary) will arrange a contractor's scheduling conference. To the extent practicable, the scheduling conference is attended by the same personnel who attended the arrival conference with the addition of key representatives of the contractor. The scheduling conference is held as soon as possible after the arrival conference.

The ship is responsible for conducting the tests necessary to determine the acceptability of the repairs performed by the private shipyard. All final tests are conducted in the presence of interested shipyard personnel, the cognizant ship surveyor, and the ship's inspector. Where new installations on the ship have been made by the private shipyard, initial test of the installation is made by the shipyard personnel and witnessed by the ship's inspector. Operation by shipyard personnel must be confined to the new installation.

When a ship's inspector is dissatisfied with the quality of the contractor's work on an individual item, he must relay his criticism to the cognizant ship surveyor who will then take appropriate action. The ship's inspector must not attempt to require the contractor's personnel to redo or otherwise amend the work. Ship surveyors hold weekly conferences with heads of departments and ship's inspectors to discuss inspections and the progress of the work being performed by the private shipyard. A signature of the person authorized by the commanding officer to accept job orders, is requested by the ship surveyor for each item of work after the work has been satisfactorily accomplished.

THE SHIP REPAIR FACILITY

The typical Ship Repair Facility (SRF) is located outside the continental limits of the United States; employs civilian personnel indigenous to the country in which it is located; and is supervised by U. S. Naval officers assisted by enlisted and civil service personnel. The SRF will have drydocks and shops capable of accomplishing nearly all ship repair work. Typical utilization includes voyage repairs and overhaul of ships whose home ports are in the area. No new construction is accomplished.

Ship Repair Facility organization is based on standard U.S. Naval Shipyard structure modified to suit the local needs. SRF organization generally differs from a shipyard as follows:

1. Supply services are furnished by a Supply Depot in the area.
2. Public works services are furnished by a Public Works Center or Department.
3. Fire protection and police services are furnished by other activities.
4. Industrial relations services are furnished by other activities.
5. Administrative services are furnished by other activities.
6. Medical and dental services are furnished by a Naval Hospital.
7. Comptroller and fiscal services are provided by a Naval Supply Depot or Naval Station.

Ship Repair Facilities are under a commanding officer, usually a Captain. An SRF is a component of a fleet activity or a shore-based naval activity which exercises military command. Management control, however, is under the Naval Ship Systems Command.

Included in the Ship Repair Facility organization under the control and authority of the commanding officer and having direct access to him, are the planning officer, the production officer, and the administrative officer. The staff of the commanding officer also includes a management engineering officer and may include a general manager for civilian personnel, who acts in an advisory capacity only.

The mission of a Ship Repair Facility is as follows:

1. Provide logistic support, including drydocking, overhaul, repair, alteration, and conversion of naval ships and service craft and ships of other government departments, as assigned.
2. Perform voyage repairs and related work, including drydocking of naval ships.
3. Install and maintain shore-based electronic equipment and provide technical guidance to assigned naval activities.
4. Perform additional related functions requested by competent authority.

The production procedures of the SRF are similar to those of the naval shipyard. The production officer assigns a ship superintendent to each ship to inspect the work performed and ensure the timely completion of job orders. The duties of the ship superintendent of an SRF parallel those of the ship superintendent of the naval shipyard.

The military staff of the production department may be paralleled by a complete civilian staff. This apparent duplication is necessary to provide liaison with the shop personnel who will be native to the country in which the SRF is located, to furnish continuity bridging officer personnel changes, and to provide direct technical assistance. (NOTE: Some fleet activities, such as Fleet Activities Sasebo, Japan, have a Ship Repair Department, referred to as SRD.)

REGULAR OVERHAUL

All ships of the fleet are assigned regular overhaul periods for maintenance and improvement. These periods usually vary from 1 month for small ships to 3 months or more for the larger ships. During the overhaul period, work pertaining to repairing, docking, and altering ships is performed by the shipyard force. The interval of time between regular overhauls, varies from a year to five years, the interval being the maximum period consistent with keeping the ships in fighting trim.

An analysis of the problems of building, overhauling, or converting ships reveals that for all three periods, the following factors play essential roles:

1. The ship must be available for the uninterrupted accomplishment of yard work. (The term associated with this is AVAILABILITY.)

2. The contemplated work must be decided upon, arranged in order of priority of accomplishment, and actually authorized to be performed.
3. Funds must be available in sufficient amount to cover the cost of the work.
4. Material must be available.
5. Men to perform the work must be available.

ADVANCE PLANNING

The advance planning stage of the regular overhaul commences approximately 18 months before the scheduled commencement of the overhaul. It is during this stage that plans progress from the very rough stage to a refined and definite schedule. In the broad sense, advance planning provides a solid foundation for the consummation of work on naval ships in all shipyards. Availabilities of ships are approved by the Chief of Naval Operations on a fiscal year basis. Prior to approval, schedules are commented on by forces afloat and the Naval Ship Systems Command.

Factors considered in formulating the overhaul schedule are: (1) the intervals between the previous overhaul availabilities of ships and the proposed overhauls; (2) the placing of ships in home shipyards or shipyards capable of performing any required special type of work; (3) the provision of continuity of work in all shipyards to avoid laying off men intermittently; (4) the probable availability of critical material on important jobs; and (5) any special factors that may arise. The final approved schedule represents the best compromise possible and is then used as a basis for planning by the bureaus, the yards, and forces afloat.

It is quite probable, in view of the remote, long-range nature of the schedule, that changes and adjustments may be required from time to time. As the need arises, proposed changes are evaluated and approved or disapproved by the Chief of Naval Operations. The administration of the schedules is delegated to the type commanders. The details of ship's availabilities, such as actual time of arrival and completion, are determined by the type commander in consultation with the shipyard commander or SUPSHIP.

Advance planning on the part of the ship is necessary to a successful overhaul. The engineer officer must provide for the preparation of or make plans to cover the following:

1. Ship's force work.
2. Training of engineering personnel during the overhaul.
3. Security of engineering spaces, including protection against fire, flooding, theft, and sabotage.

All work within the capacity of the ship's force should be accomplished by personnel of the ship. The cost of such work when performed by the shipyard, is normally disproportionate to the value received. A schedule of ship's force work should include names of persons responsible for accomplishment, estimated date of completion, estimated number of man-hours required, and the assistance in way of materials or tools required from the yard. Copies of the ship's force work item list must accompany the ship's repair requests and work item lists.

Plans for training during the overhaul period should outline the objective to be accomplished by the end of the period. Local training facilities and fleet schools should be utilized to the maximum degree consistent with obtaining a good overhaul.

Regular overhaul periods provide a time for clearing up backlogs of leave accrued while the ship was in an operational status. The plans should provide for an equitable distribution of leave to personnel while maintaining a force of inspectors who are capable of inspecting work for the ship and sufficient other personnel to ensure timely accomplishment of the ship's force work items. A period of turnover should be arranged between the return of one leave party and the departure of another.

While the ship is undergoing overhaul, special precautions against fire, flooding, theft, and sabotage must be taken. The shipyard is prepared to give assistance in matters of security but the responsibility for establishing security measures remains with the ship. The plan should include the necessary organization for:

1. Precautions Against Fire. The greatest continuous hazard to ships undergoing overhaul is fire. Disruption of firefighting facilities and burning or welding work in progress are the most dangerous conditions contributing to fire hazards. The ship is responsible for providing fire watches, properly instructed, to each burning or welding job in progress aboard ship. All watch personnel should be instructed in the location of shipyard fire alarm boxes closest to the ship, and the current shipyard directives concerning fires and firefighting.

2. Precautions Against Flooding. The possibility of engineering spaces flooding through sea connections or through leaks in piping systems must not be overlooked. The security plan should require frequent inspections to be made of all unattended spaces in which possibility of flooding exists.

3. Precautions Against Theft and Sabotage. Responsibility for security of the ship against acts of theft or sabotage will rest largely with the security watches and inspectors of shipyard work. Tact should be exercised in enforcing certain security measures in order that no offense will be given to shipyard personnel. To reduce the possibility of theft, all tools, valuables, and clothing should be placed in locked stowage. Storage spaces within the shipyard may be available to the ship for such purposes. Acts of sabotage can best be counteracted by the vigilance of watch and duty personnel. Periodic patrols conducted at irregular intervals through ship's spaces and proper identification of all personnel boarding the ship are basic requirements for security.

ASSIST-SHIP'S-FORCE FUNDS

During an overhaul period (and certain restricted availabilities) a portion of the repair funds may be designated as an assist-ship's-force fund. The fund, under the local control of the ship's commanding officer without further reference to the type commander, provides a means for the ship undergoing overhaul to obtain minor shipyard assistance (in the nature of services, labor, or special tools and equipment) to aid in the completion of work undertaken by the ship's personnel. No work can be undertaken for assist-ship's-force funding in which the ship's force does not participate. Generally, the engineer officer in conjunction with the ship superintendent (or ship surveyor) administers the assist-ship's-force fund. Care must be exercised not to expend the funds early in the overhaul. This can best be avoided by careful screening of requests for assistance and the employment of accurate accounting measures.

DOCKING

Docking of naval ships in drydock or in marine railways is accomplished either to permit routine painting of the ship's hull and examination of the underwater fittings of a ship or to accomplish repairs of damage. The first is termed a ROUTINE DOCKING and is carried out during regular overhaul periods at intervals established by the Naval Ship Systems Command. The latter is called an EMERGENCY DOCKING and is accomplished as the need arises.

The officer in charge of the general operation of the drydock and responsible for the preparation for and the actual docking and undocking of ships is the docking officer (naval shipyard) or dock master (private shipyard).

Based on approved overhaul schedules, a docking schedule is prepared for several months in advance of any given date. This schedule is used for planning purposes to ensure the availability of docking facilities for all possible uses. It is customary to schedule the docking of a ship as early in the overhaul period as possible to ensure completion of all required work (its extent can never definitely be determined until after the actual docking) and to avoid interference with other planned work which must of necessity be performed late in the overhaul (such items being machinery trials and strength tests of structural work).

The remainder of this discussion concerning docking of the ship states the procedure for docking a ship in a naval shipyard. The procedure for docking a ship in a private shipyard will not differ greatly.

As soon as a ship scheduled for docking enters the shipyard, a shipwright from the docking crew obtains from the ship its docking plan and checks the draft and the list of the ship. The shipyard usually has available in its files copies of docking plans of all ships it customarily docks; the applicable plans are checked against the ship's copy to ascertain that any corrections caused by work accomplished elsewhere are properly noted. The docking officer visits the ship about one week prior to the actual docking and discusses detailed docking arrangements.

Points covered include (1) a detailed examination of the docking plan is made to determine any errors or discrepancies (2) a determination is made of the location of the mooring lines and the number and location of the line-handling parties on board ship, (3) the maximum permissible trim is set and the importance of the ship entering with zero list is emphasized (4) the scheduled drydock work is discussed, (5) the ship is notified that the shipyard watch officer will arrange for tugs and pilot service, and (6) a determination is made from the ship's last docking report which position the ship was last docked in, so that it can be changed for this scheduled docking to facilitate cleaning and preservation of the underwater body.

In laying out a drydock the ship is generally located as close to one end of the drydock as practicable to make possible the setting of blocks for the following ship. Dimensions are ordinarily taken from the after edge of the ship's main deck to the after edge of each block. This determines the fore and aft location of the blocks. The shipwrights determine the fore and aft centerline of the keel blocks and the athwartship locations of the blocks are measured from this line. Vertical heights are measured from a plane established by a public works engineer. After the dock has been set and prior to flooding, the docking officer and the dockmaster (shop 64) check the dock, covering the following points with particular attention:

1. The location of the mark on the dock utilized to locate the stern of the ship.
2. The location of the first (after) keel block and all hauling blocks.
3. The heights of all hauling blocks to ensure sufficient clearance under the bilge keels, even if the ship has a slight list.
4. The avoiding of interference between sea valves or hull fittings and any blocks.
5. The height, shape, bevel, and location of cradle blocks.
6. The existence of projections below the baseline, to avoid any interference on landing or in hauling the ship into the drydock.

After the dock has been completely checked, the docking officer gives the order to flood the dock. He remains at the dock until all the blocks are well covered to ensure that no blocks are torn loose or misplaced during the flooding process. A working party for handling the lines of a ship being drydocked is generally furnished by the ship at the request of the yard. If this is not possible, it is furnished by other ships as directed by the commander, or by a detail of yard labor.

Prior to the entrance of the ship into the dock, the docking officer instructs the working party in their duties. The commanding officer of the ship being docked is in charge until the bow (or stern, if docked stern first) reaches dock sill and the ship is pointed fair for entering. The docking officer then takes formal charge until the ship has been landed, the bilge blocks hauled, and the dock pumped down. Under the direction of the docking officer, lines are handled to ensure safe entrance of the ship into the dock. Breast and spring lines are kept abreast their positions on the ship and where two lines lead from one bow or quarter, one must be led over a bollard or capstan while the other is shifted. This permits control of the ship at all times.

Certain procedures and precautions applicable to docking a ship follow:

1. On entering dock the ship should be without list and without excessive trim. All equipment whose operation requires it to extend beyond the hull should be refracted or housed prior to entering the dock.
2. No weight or ballast may be shifted, added, or removed while the ship is in drydock without the permission of the yard. It is the responsibility of the commanding officer to keep an accurate record of any weight changes authorized by the yard.
3. From the time of entering the dock, propellers must not be turned without permission of the docking officer.
4. U.S. Navy Regulations sets forth the requirements regarding the closing of all bottom openings outside of working hours.
5. No fuel oil, gasoline, or other flammable liquid may be drained into the dock. If the need arises, the yard will provide special containers for the disposal of such liquids.
6. Where direct sewerage connections are provided in the dock, washrooms and heads are connected to them. Where there are no sewerage connections, facilities on the dock are used, but, with permission, washrooms may be drained directly into the dock.
7. During freezing weather, all pipes, valves, and fittings attached to the shell should be drained of water to prevent cracking due to freezing.
8. All guardrails around the dock are to be kept in place, except during actual docking and undocking operations.

The ship is usually towed into the dock by means of a towline, one end of which is secured to the ship and the other end to a power winch or capstan at the head of the dock. When the ship is in approximate location, the caisson at the entrance of the dock is replaced and sunk. Pumping operations then commence. The ship is located in the position she is to take when the dock is dry. This position is meticulously checked and maintained, especially immediately prior to landing. The drafts of the ship at landing are recorded and checked to ensure that the ship lands at the proper drafts.

During the pumping operation if the ship develops an undue list or lands before the water has dropped to the proper depth, or if a shore buckles on landing, the pumping is stopped, the dock flooded if necessary, and the cause of the difficulty determined and corrected before proceeding. The engineer officer should make a thorough inspection of the ship's bottom and fittings as soon as possible after the dock is pumped dry. Results of the inspection will be logged in the ship's log and the Engineering Log.

While in drydock, the docking officer is responsible for all routine underwater work, and the ship superintendent is responsible for all other work. Other repair work scheduled for the ship is continued while the ship is in drydock insofar as it does not interfere with work in the drydock. The following are examples of the instructions (of particular importance to the ship's engineer officer) given to the various shops by means of the regular docking job order:

SHOP 64—Set up blocks, remove and replace blocks as necessary, align ship dock. Strike in waterlines at drafts furnished by the commanding officer. Notify the design superintendent of any discrepancies in the docking plan.

SHOP 11—Examine and report to the docking officer on:

1. Condition of plating around each composition article where zincs are not fitted. Any definite evidence of local electrolytic attack adjacent to propellers or other composition articles is to be reported.
2. The number and condition of zincs, and the condition of plating in the vicinity of which zincs are fitted. Replace zincs that are at least 40 percent corroded.
3. Inspect bottom and make necessary routine structural repairs. Remove hull strainers, inspect sea chests, and replace strainers. Particular attention is to be paid to rivet points, butts, seams, and conditions of plating. Examine hull fittings and underwater sound equipment. Inspect for leakage of rudders and all compartments, such as skegs which are accessible for inspection only when the ship is in drydock. If evidence of leakage exits, make necessary repairs and air-test.
4. Inspect propeller shaft struts and rudder to ascertain need for thiokol application as required by Naval Ship Systems Command directive.

SHOP 41—Remove, repair, and replace welded fairwaters and rope guards in connection with shaft work.

SHOP 26—Do welding and cutting as required.

SHOP 31—Do machine work as required to assist ship's force in overhauling sea valves. Do machine work as required by shops in connection with their routine drydock work and make docking report to docking officer.

SHOP 38—Accomplish the following:

Take such rudder clearances as practicable without unshipping the rudder. Examine stern tube and strut bearings, propellers, couplings and shafting, and repair minor defects (including repair of all nicks and bends in propeller blade edges). Report such propeller blade repairs to the senior planning and estimating superintendent for machinery. Remove and replace bolted fairwaters and guards. Remove dunce caps, test propeller nuts and keepers, remove key covers, and test coupling keys. Ship's force examine sea valves and make request to assistant planning and estimating superintendent concerned for repairs as necessary. Rudder and stern tube packing to be renewed by shipyard only when specifically requested by the commanding officer as beyond the capacity of ship's force. Report shaft clearances and rudder data to docking officer by telephone as soon as information is available. Follow up with a written report. Take propeller data and make a written report to docking officer.

SHOP 51—Disconnect and remake electrical connections and remove and replace portions of cables as required by sonar laboratory and shop 38 in inspecting and testing sonar hull units. Provide power leads for plastic paint pots as required.

SHOP 56—Install and remove necessary piping from the scuppers on the side of the ship to the sewerage lines or drains in the dock. Install and remove plugs in overboard discharges. Dry sandblast and apply thiokol to propeller shaft struts and rudder as directed by the docking officer.

SHOP 71—Make a thorough inspection of bottom immediately after water recedes from dock to obtain data required for docking report. The shop branch (production department) furnishes assistance in identifying biological types of fouling. Remove paint from sufficient number of small areas on the bottom to determine extent of black oxide beneath the film. Sandblast bottom, if directed by the docking officer. Paint the bottom.

SHOP 72.—Furnish necessary labor to dock and undock. Rig stages for cleaning and painting the bottom. Furnish incidental labor required by the various shops for dock work.

SHOP 99—Furnish services as required.

PAINT LABORATORY—Measure film thickness of newly applied paint. Inspect previously applied thiokol for performance. Make written reports to docking officer.

METALLURGICAL LABORATORY.—If thiokol is applied, measure surface temperature during application, as directed by the docking officer.

DESIGN DIVISION.—Correct docking plan discrepancies reported by Shop 64; carry out procedure for standardized docking plans.

When work in the drydock has progressed to such a point that its completion can be accurately forecast, the ship is scheduled to be undocked. Certain preliminary arrangements are made under the direction of the docking officer prior to flooding. These are as follows:

1. The disposition of the ship after it leaves the dock is determined.
2. The line-handling party is instructed and detailed to lines.
3. Men are stationed at all newly completed work to be ready to detect leakage.
4. All staging and loose material is removed from the dock.
5. The pumping plant is readied for operation in the event it is necessary to pump down.

When the preliminary arrangements have been made, the dock is flooded to a point which lacks about 2 feet of lifting the ship from the blocks. Flooding is stopped. Each shop that performed underwater work checks its work for tightness and the ship's personnel make an overall check of the watertight integrity. Reports of satisfactory condition are made to the docking officer prior to resuming flooding. Should an undue list develop upon lifting, flooding is stopped and the necessary corrections are made prior to proceeding. The docking officer directs the handling of the lines during undocking, and through the pilot, controls the movements of the tug towing the ship out. The docking officer is in direct charge of the undocking until the bow crosses the sill. After the ship is clear, the caisson is replaced, the dock pumped down, and the blocks are set for the next ship.

Within ten days of the undocking of a ship, a report is submitted by the docking facility to the Naval Ship Systems Command with copies to the commanding officer and type commander. The report includes in general:

1. Name and class of ship, place and date of docking and undocking, reason for docking.
2. Draft readings at docking and undocking.
3. The number of days underway, not underway, and waterborne since last docking.
4. The formula and extent of bottom painting. The performance of the previous coat of paint. The method of application and amount of paint used.
5. Shaft and rudder clearances.
6. The details of all other work performed.

Each shop performing underwater work submits a report on its work to the docking officer, who checks each report and makes out the smooth report.

INCLINING EXPERIMENTS

Inclining experiments are conducted on ships when directed by the Naval Ship Systems Command. The purpose is to determine the vertical position of the center of gravity of a ship. During the construction of ships, all components entering into construction are weighed, and from the recorded weights and locations aboard ship the vertical position of the center of gravity may be calculated. Even though a ship has been weighed during construction, it is customary to perform an inclining experiment on the first completed ship of a class. Periodically thereafter, throughout the life of a typical ship of a class, the experiments are repeated to determine any rise in the center of gravity due to added weight over a period of years, and to compute the effect of this rise on the stability characteristics of the ship. The experiments are conducted while the ship is

212

waterborne in a drydock (to eliminate effects of currents or waves) or at a pier having adequate weight-handling facilities. The experiment itself consists of moving known weights certain specified distances across the deck and recording the angles of heel produced. The free movement of the ship must not be impeded by any mooring lines or shore connections such as hoses and brows.

The role each naval shipyard department plays in the experiment is outlined below:

1. Planning department.—The planning and estimating division authorizes the experiment by issuing a job order after receipt of a bureau directive. The design division makes arrangements for the experiment and is in charge of conducting it. Upon completion, a preliminary, abbreviated report is made to the Naval Ship Systems Command followed by the preparation of a formal booklet of inclining experiment data.

2. Production department.—Prepares the ship for the experiment (less the preparatory work assigned to the ship's force). It provides required services, equipment, and personnel for the conducting of the experiment. It makes arrangements for tugs and pilots and furnishes information regarding work yet scheduled to be accomplished during the overhaul. The ship superintendent is in direct charge of the production departmental personnel. He attends conferences at which arrangements and procedures are discussed and decided; removes shipyard equipment and dunnage from the ship; removes free liquids from the bilges and fills and empties tanks as required; checks to see that all excess yard personnel have left the ship and that all shore connections are broken. Shop 64 sets up the equipment used for measuring the angles of inclination and installs cribbing, tracks, and shoring for the inclining weights. Shop 72 furnishes inclining weights, the men and crane service to handle the weights, personnel for handling rigging and moving lines, and small boats and crews. Shop 51 provides and installs a sound-powered telephone circuit connecting all inclining stations. The chief chemist analyzes the specific gravity of materials submitted by the design division.

3. The administrative department.—Furnishes tugs and pilots as requested.

4. The design division of the planning department.—Takes photographs of the ship being inclined.

The commanding officer of the ship brings the ship to the conditions specified by the design division, furnishes detailed information regarding the types, quantities, and locations of the ship's equipment, stores, and liquids, and supplies the service of the ship's personnel to assist in conducting the experiment.

POST REPAIR TRIALS

Near the end of every overhaul during which major repairs are accomplished on machinery, appropriate trials are conducted to test the overall effectiveness of the repairs. The commander of the naval shipyard (or SUPSHIP) and the commanding officer of the ship determine the nature and extent of the post repair trials based on the work performed. A full power trial should be scheduled following each regular overhaul to ascertain that the propulsion plant is capable of full power operation. The object of the post repair trials is to ascertain if the work has been completed, if the results sought have been fully accomplished, and if the ship (including machinery, weapons, and electronics) is in all respects ready for service.

Post repair trials, if practicable, are witnessed by the ship superintendent (or ship surveyor), any shipyard (or SUPSHIP) personnel he shall designate, and a duly appointed representative of the ship, to observe whether or not the work performed is satisfactory. When the overhaul is accomplished at a private shipyard, the contractor is permitted to have representatives on board to witness the trials.

Dock Trial

As soon as practicable after the work has been completed, the commanding officer directs the engineer officer to conduct a dock trial to ascertain the exact condition of the electrical and main propulsion plants. The trial is witnessed by the ship superintendent (or ship surveyor). Any defect, deficiency, or maladjustment discovered must be corrected, supplied, or remedied and another trial made. The dock trial is repeated until the condition of the engineering plant is reported satisfactory by the engineer officer. The conditions to be observed and the operation of machinery performed during the dock trial are discussed in chapter 12 of this publication.

Sea Trial

As soon as practicable after completion of the dock trial, when the persons responsible for the adequacy of the work are satisfied that the equipment is ready in all respects, a sea trial is conducted if the shipyard commander (or SUPSHIP) and the commanding officer consider it necessary. The trial is conducted by the commanding officer. The conditions of the trial are determined mainly by the character and magnitude of the work that has been performed and are conducted in such manner as the commanding officer and the naval shipyard commander (or SUPSHIP) deem necessary and sufficient. A full power trial, if required, is conducted during the sea trial, except when the commanding officer considers it desirable to delay such trial until new machinery parts have been properly run in and the training status of the crew will permit full power operation of the propulsion plant without undue hazard to the machinery.

READINESS FOR SEA

Normally, the cognizant type commander allots the ship a readiness for sea (RFS) period immediately following the overhaul. The time is for use by the ship's force to complete additional preparations prior to return of the ship to unlimited operational status. The time may be used (1) to load ammunition and supplies, (2) for special exercises and maneuvers at sea, or (3) to prepare for a special mission. The RFS period alloted to a ship will not (normally) exceed 7 days and frequently it will be less. If there is an immediate special operational need for the ship, the RFS period may be omitted entirely. Neither the shipyard commander nor SUPSHIP are permitted to use the RFS period for the accomplishment of work items that the shipyard has been unable to complete prior to completion of the overhaul. If additional time is needed by the shipyard, an extension of the availability should be requested from the cognizant type commander.

DEPARTURE REPORT

At the completion of an overhaul, a departure report is prepared and submitted by the planning department of the naval shipyard or SUPSHIP. The basic purpose of the report is to acquaint all activities interested in the overhaul with what work was scheduled for accomplishment, how much was completed, and what the actual cost was. The report enables the ship to correct its records that summarize the material condition of the ship; it permits the cognizant type commander to evaluate the overhaul and to adjust and account for the repair funds allotted to him for administration; and it supplies the cognizant bureaus with information on alteration accomplishment and funds expenditures. The report furnishes the specific information desired by the various bureaus.

214

CHAPTER 11

SHIPBUILDING, INACTIVATION, AND ACTIVATION

When a ship is needed to augment the active fleets, it may be procured by constructing a new ship, converting an older ship, or activating a ship from one of the reserve fleets. When the services of a ship are no longer required by the active fleets and the ship must be held in readiness for future use, the ship is placed in an inactive status (out of commission, in reserve) in one of the reserve fleets. This chapter contains information concerning the procurement of ships (new construction, major conversions, and activation) and the laying up of ships (inactivation) for possible future augmentation of the active fleets.

NEW CONSTRUCTION AND MAJOR CONVERSIONS

The Naval Ship Systems Command is assigned procurement responsibility for the design, construction, and conversion of all Navy ships and craft with the exception of certain service craft assigned to the Naval Facilities Engineering Command. For the construction and conversion of a Navy ship, the Naval Ship Systems Command may either (1) award a shipbuilding contract to a private shipyard, or (2) assign a project order to a naval shipyard.

Each year the Naval Ship Systems Command reviews the entire shipbuilding and conversion program expected to be approved and funded by the Congress in order to determine in each case whether to award a shipbuilding contract competitively to a private shipyard or to recommend assignment to a naval shipyard. The review considers such factors as (1) the type and complexity of construction involved, (2) the urgency of the delivery date, (3) the past performance of the various eligible shipyards (with respect to quality of workmanship, timeliness of delivery, and final costs), (4) the projected workload capacity of the shipyards being considered, and (5) the number of similar ships in the program. Recommendations as to the means of carrying out the program are submitted by the Naval Ship Systems Command to the Secretary of the Navy and the Secretary of Defense. For the construction of warships, Congress has prescribed a pattern requiring that ships be built alternately by naval and private shipyards. Exceptions to the pattern require the approval of the President, and are normally included in his directive to execute the shipbuilding program approved by the Congress.

Prior to awarding a shipbuilding contract to a private shipyard, invitations to bid are prepared and advertised to interested and qualified contractors. On a designated date, after all bids from the contractors have been received and opened, the Naval Ship Systems Command determines the bid best suited to the interests of the government, conducts additional negotiations as necessary, and awards the shipbuilding contract.

Each shipbuilding contract contains general and specific provisions. The general provisions concern general concepts and procedures related to inspection, changes, delays, preliminary and final acceptance, guarantees, and availability of plans. The general provisions also include insurance, military security and handling, installation of government furnished material, general specifications for the handling of material, and various laws and acts of Congress relevant to the contract. The special provisions of the contract indicate the parties concerned (the government and the contractor), the type and number of ships to be constructed or converted, and the price for the execution of the contract. Special provisions also define the scope and limitations of the contract, establish the completion and delivery dates for the ship, and contain any changes, modifications, or amendments to clauses of the general provisions.

A shipbuilding contract is not necessary when the ship construction or conversion is to be accomplished in a naval shipyard. Instead, the Naval Ship Systems Command issues to the naval shipyard, approved by the Secretary of Defense, a project order to cover the cost of the ship being constructed or converted.

Each office of the Supervisor of Shipbuilding (SUPSHIP) is under the management control of the Naval Ship Systems Command and the military control of the district commandant of the naval district in which the office is located. The basic mission of the office of the SUPSHIP is to administer for the Navy Department and other departments of the Department of Defense the shipbuilding, design, conversion, repair, and facility contracts that are performed at plants under cognizance of the office of the SUPSHIP. Information dealing with additional functions of SUPSHIPS is discussed in chapter 10 of this publication; therefore, it will not be covered in this chapter.

THE NUCLEUS CREW

Naval personnel, both officer and enlisted, ordered directly to the building shipyard or reactivation activity prior to the commissioning of the ship form the nucleus crew of the ship. Officers of the nucleus crew normally include the prospective commanding officer and the prospective heads of departments. Certain other key officers may be assigned depending on the type of ship involved. The district commandant of the naval district in which the shipbuilding, conversion, or activation is being accomplished is the reporting senior of the prospective commanding officer of the ship until the ship reports to a fleet or operational commander. The district commandant is the reporting senior for the other officers of the nucleus crew until the ship is commissioned. Officers of the nucleus crew are ordered to report to the district commandant for temporary duty in time to arrive at the building or conversion yard 6 to 12 weeks prior to the completion or commissioning date of the ship.

The enlisted component of the nucleus crew includes certain key petty officers (approximately twenty percent of the ship's allowance) who are generally ordered to report to a naval activity in the vicinity of the shipyard 10 weeks in advance of the ship's completion or commissioning date. When berthing and messing facilities are available at a private shipyard, and the nearest naval activity is at such a distance as to make daily commuting impracticable, the Chief of Naval Personnel may authorize (by correspondence) transfer of the nucleus crew personnel from the naval activity to the private shipyard. In addition, the Chief of Naval Personnel may designate the SUPSHIP or a representative from his office as commanding officer of the enlisted personnel of the nucleus crew.

The balance of the crew, both officer and enlisted personnel, are normally assigned to a fleet training center for precommissioning training. The training is usually scheduled to permit the balance of the crew to report to the ship one week in advance of the completion or commissioning date.

The nucleus crew is organized into the departments represented, headed by the prospective heads of departments or senior departmental officers present. The crew functions under the direction of the prospective commanding officer, or, if he has not reported, the senior line officer member of the crew. The prospective commanding officer has no independent authority over the preparation of the ship for service by virtue of his assignment until the ship is commissioned and transferred to his command. When requested (usually 10 weeks prior to commissioning), the prospective commanding officer submits a weekly progress report to the Chief of Naval Operations stating his views concerning the general condition of the ship and any existing deficiencies in material and personnel.

The precommissioning duties performed by the prospective officer include:

1. Conducting frequent inspections of all engineering spaces and machinery installations, and keeping himself and the prospective commanding officer informed of the condition of the spaces and the progress of the work.
2. Reporting all unsatisfactory items and deficiencies to the prospective commanding officer, and recommending essential changes and alterations including revisions in allowance lists intended to improve the ship's effectiveness.
3. Organizing the engineering department and developing plans for the administration and training of engineering personnel after the commissioning.

4. Directing the training of engineering personnel of the nucleus crew to ensure thorough familiarization with all machinery, equipment, and readiness for sea procedures.

5. Witnessing tests and trials of engineering equipment and machinery.

The tasks of the nucleus crew of a ship that is being constructed or converted include:

1. Assisting in the assembly of the precommissioning outfit.

2. Witnessing tests of machinery and equipment and assisting in the identification of deficiencies.

3. Familiarizing themselves with the details of operation of the ship.

4. Instructing the balance of the crew when they report.

The tasks of familiarization and training are the two most important jobs of the nucleus crew. It is primarily during the few weeks that the nucleus crew is aboard that the knowledge and practical information about the characteristics of the equipment and machinery of the ship must be funneled from her designers and builders to the operating crew. The development, implementation, and coordination of an effective training program are basic responsibilities of the prospective commanding officer and every member of his nucleus crew. The inspection officer of the SUPSHIP office or the ship superintendent in the naval shipyard are in good positions to assist the nucleus crew in securing instructors, classrooms, and training aids. In addition to the qualified instructors in the nucleus crew, instructors for formal presentations and on the job training are readily available among the technical and production personnel of the building yard and the service engineers assigned to the yard to assist in the installation, activation, and testing of the more complex equipment installed in the ship.

Each prospective engineer officer assigned to a nucleus crew should obtain a current copy of Orientation For Nucleus Crews Assigned To New Construction And Conversion Ships, NavShips 250-710. Copies of the manual are generally available at the SUPSHIP office or naval shipyard.

SHIPBUILDING PROCEDURES

The operational requirements for a new naval ship are prescribed by the Chief of Naval Operations. With the requirements as a guide, the Preliminary Design Section of the Naval Ship Systems Command develops the preliminary plans and specifications of a number of variations within the general type of ship required, and examines and analyzes them to determine various optimum hull forms and arrangements. The resulting studies are presented to the Ship Characteristics Board where alternate designs are considered and recommendations are made to the Chief of Naval Operations. After approval of a preliminary design, a more extensive contract design with the accompanying detail and special specifications are developed sufficiently to allow a ship construction activity (government or private) to prepare working plans and construct the ship desired. The construction of the desired ship may involve building a new ship or converting a ship that is already built. The general specifications for naval ship construction published in General Specifications For Ships of the U.S. Navy normally apply except as modified by the special specifications for a particular ship class.

Ship Plans

Many ship plans are required for the construction, conversion, operation, and maintenance of naval ships. Some of the plans are a valuable source of information for the prospective engineer officer and will help him become familiar with the design and construction features of his ship.

CONTRACT PLANS are NavShips plans forming part of the contract, and illustrate design features of the ship from which no departure in the development of plans by the contractor is permitted unless such departure is specifically approved. They consist of: (1) Hull Contract Plans, (2) Machinery Contract Plans, (3) Electrical Contract Plans, and (4) Electronics Contract Plans.

CONTRACT GUIDANCE PLANS are NavShips plans forming part of the contract, and illustrate design features of the ship subject to development. The design features are acceptable to NavShips but will not necessarily be subject to strict compliance provided the required results are accomplished. The plans may consist of: (1) Hull Contract Guidance Plans, (2) Machinery Contract Guidance Plans, (3) Electrical Contract Guidance Plans, and (4) Electronics Contract Guidance Plans.

STANDARD PLANS are NavShips plans illustrating arrangement or details of equipment, systems or components from which no departure in the manufacturing of parts or intent of use is permitted without prior approval from NavShips. They may consist of: (1) Hull Standard Plans, (2) Mechanical Standard Plans, (3) Electrical Standard Plans, and (4) Electronics Standard Plans.

TYPE PLANS are NavShips plans that illustrate the general arrangement of systems or components that will be satisfactory for NavShips purpose but that will not necessarily be subject to strict compliance as to details provided the required results are accomplished. They may consist of: (1) Hull Type Plans, (2) Mechanical Type Plans, (3) Electrical Type Plans, and (4) Electronics Type Plans.

PRODUCTION PLANS are manufacturers' plans illustrating mechanical and electrical equipment (exclusive of electronic equipment). They consist of: (1) Class A and Class C Master Plans (ship identification numbers are not shown because there are no features exclusively applicable to any particular ship), and (2) Class B and Class D Other Plans (ship identification numbers are shown because some part or feature is applicable only to a particular ship). These are manufacturers' working plans.

CONSTRUCTION PLANS are the contractor's plans that are necessary for construction of the ship or for illustration of the ship constructed.

WORKING PLANS are those Construction and Manufacturers' Equipment Plans which are necessary for the construction of the ship. They are directly associated with the ship and system arrangement, fabrication, and installation. They are developed from the specifications, Contract Plans, and Contract Guidance Plans.

SELECTED RECORD PLANS are a designated group of Construction Plans applicable to an individual ship and illustrate important features, systems, and arrangements. They are maintained correctly throughout the life of the ship by the Government. Selected Record Plans include: (1) Booklet of General Plans, (2) Docking Plan, (3) Schedule of Watertight Integrity Tests and Inspections, (4) Compartment of Tanks-Testing Requirements, and (5) tank capacity curves and curves of the vertical center of gravity.

ONBOARD PLANS are a designated group of Construction and Production plans illustrating those features considered necessary for shipboard reference. The builder is required to furnish the ship with a set of Onboard Plans as prescribed in chapter 9001 of the Naval Ships Technical Manual.

The builder is required to furnish the ship with two copies of the Ship's Plan Index (SPI) applicable to the ship concerned. The Ship's Plan Index is required to include all plans applicable to the ship concerned, except as follows:

Where a plan list drawing is available which lists all plans applicable to any item of machinery and equipment, the plan list drawing is listed in the SPI, but the detailed plans of the item concerned, which are listed on the plan list drawing, are not listed in the SPI. This also applies to miscellaneous items such as lighting fixtures and appliances, and interior communication equipment, where such items are covered by construction plans listing the various items by plan numbers.

Standard or commonly used items covered by Bureau Standard or Type Plans, such as valves, pipe fittings, air ports, and lockers, are not included in the SPI if they are listed by plan numbers on other construction plans covering the systems, spaces, or equipment concerned.

For ships having an overall length of 200 feet or more, a separate Ship's Plan Index is required for each ship. For ships having an overall length of less than 200 feet, a single SPI covering all ships of the same design class built by the same shipbuilder is required.

The preparation of Ship's Indexes for naval ships was initiated by instructions issued in May 1944, and, therefore, these Ship's Plan Indexes are available only for ships recently constructed. Present instructions require that, except for ships having an overall length of less than 210 feet, the individual Ship's Plan Indexes be corrected by the overhaul yard accomplishing work on the ship concerned, to record new plans, showing important alterations, and that revised sheets of the SPI be distributed to the ship concerned and other activities holding copies of the SPI.

For the larger and more important older ships for which there are no individual Ship's Plan Indexes, it was directed by NavShips (in April 1945) that a Modified Ship's Plan Index be prepared. The preparation of the Modified Ship's Plan Index was to be initiated by the overhaul yard at the time of accomplishment of important alterations on the ship concerned. Because of the difficulties involved, the naval shipyards were not required to include a record of alterations accomplished prior to April 1945. The Modified Ship's Plan Index is required to list new plans covering alterations actually accomplished together with existing plans affected by such alterations. Copies of the Modified Ship's Plan Index are required to be furnished by the overhaul yard to the ship concerned, to all naval shipyards, and to NavShips.

In ships having an overall length of less than 210 feet, correction of existing Ship's Plan Indexes or the preparation of Modified Ship's Plan Indexes is not required.

At the time of completion of a ship, the shipbuilder is generally required to furnish the ship with a set of blueprints of selected record plans plus any corrected plans (those plans which have been corrected to illustrate final ship and system arrangement, fabrication, and installation) selected by either NavShips or the SUPSHIP. In addition, a set of blueprints of the production plans, applicable to the ship and selected by NavShips, is also furnished to the ship. As far as newly constructed submarines are concerned, onboard plans are now required to be furnished in the form of reduced size booklets.

The plans furnished to a ship at the time of completion include only those plans considered by the Naval Ship Systems Command and the SUPSHIP as being necessary on board the ship. The prospective engineer officer should not use the SPI as a checkoff list for the purpose of obtaining a complete set of all the plans listed therein, because it would involve an unnecessary expenditure of manpower on the part of the ship's personnel as well as NavShip personnel in providing, indexing, and filing many plans that would seldom, if ever, be required on board ship. When experience indicates the need for additional plans, they can be requested from NavShips at the time the need becomes apparent. For the selection of onboard plans for his ship, the prospective engineer officer should refer to the list of plans in chapter 9001 (2) of the Naval Ships Technical Manual.

Construction Stage

When the working plans for the construction or conversion of the ship have been completed and approved by the SUPSHIP or naval shipyard commander, the construction or conversion of the ship is undertaken. The various stages of the shipbuilding and the materials, procedures, and processes used by the building yard are under continuous surveillance of the inspection department of the SUPSHIP or the production department of the naval shipyard, including assigned supervisory and inspection personnel, to ensure conformance with the approved plans and specifications.

After the working plans for the ship have been officially approved, they are considered fixed and any variations or changes to the plans or to the ship covered by the plans must be approved by the SUPSHIP or the shipyard commander. Changes and alterations within the scope of the basic plans and specifications are usually approved locally; those involving changes in the contract or contract guidance plans or in the detail specifications are submitted to the Naval Ship Systems Command for final approval. Requests for changes or alterations to ships being constructed or converted in private shipyards are submitted to the SUPSHIP for his approval or to the Naval Ship Systems Command, via the SUPSHIP, for final approval. In naval shipyards, requests for changes or alterations are submitted to the design division of the planning department. A change representing deviation from the approved plans and specifications is usually issued in the form of a formal change from NavShips modifying, as necessary, the basic plans and specifications. It is issued by SUPSHIP as a change order to a shipbuilding contract (private shipyard) and has the effect of legally modifying the basic contract and necessitates adjudication to establish the increase or decrease in the contract price occasioned by the change. If the military characteristics of the ship are affected by the change or alteration, the request must be forwarded to the Chief of Naval Operations for action.

Recognition of essential changes and alterations in the ship is one of the responsibilities of the nucleus crew. Certain such work items are minor and may be accomplished at little or no additional cost in labor, material, weight, and stability. The problem that often must be solved by the prospective engineer officer is to determine what changes are essential and what manner of effecting them is the most expeditious and least expensive. The prospective engineer officer can usually gain considerable assistance in evaluating the necessity for the change or alteration by liaison with the nucleus crews of ships of the same class being constructed or converted in other shipyards. Liaison with sister ships in commission generally proves even more helpful. The prospective engineer officer may also receive assistance by consulting inspection, production, and design personnel of the SUPSHIP office or the naval shipyard.

Because of the shipbuilding contract between the Naval Ship Systems Command and the private contractor, situations permitting claims for additional cost, delay, or termination of the contract must be avoided by the members of the nucleus crew. The prospective engineer officer must treat all requests for changes and alterations in accordance with the provisions of the contract and requests must be handled entirely through established procedures. All requests for changes or alterations, however minor, must be submitted to the SUPSHIP via the proper channels. The prospective engineer officer should direct his personnel to submit to him all potential requests for modifications or improvements, as well as all unsatisfactory items detected. After screening the items and requests, the prospective engineer officer should submit those requiring further action to the prospective commanding officer.

As the ship nears completion, a series of tests and trials (including those prescribed in test memoranda developed from the ship's specifications) are conducted by the building yard to demonstrate that the ship is seaworthy and that the machinery and equipment are operational and ready for acceptance by INSURV. These tests frequently represent the initial activation and operation of much of the ship's equipment and machinery, therefore, some difficulties and problems will occur. Although correction of such deficiencies and inspection and acceptance are functions of the builder, members of the nucleus crew can gain considerable knowledge of the equipment and machinery by witnessing the tests and observing any corrective action taken. The nucleus crew must be aware of any malfunctions encountered during the tests and trials in order to: (1) ensure that any unsatisfactory conditions are corrected, (2) make use of such information if later casualties are experienced during post-commissioning operations, and (3) evaluate the effectiveness of corrective measures. All ship trials necessary to acceptance of a ship by the Navy are discussed in detail in chapter 12 of this publication.

Completion and Commissioning

The date of completion of a ship being constructed or converted in a private shipyard is the date when the construction or conversion is completed and the stage of completion permits the ship's departure from the shipyard. This stage includes satisfactory completion of acceptance trials and the mandatory work resulting therefrom designated for completion by the contractor prior to delivery to the designated naval activity. At completion, the ship is delivered and upon acceptance from the contractor becomes the responsibility of the Navy. The contractor, however, is not freed from his contractual obligations until expiration of the guarantee period (approximately 6 months from the date of delivery as specified in the shipbuilding contract). As soon as possible after delivery, the commandant of the naval district in which delivery is made (or his designated agent) places the ship in commission as directed by the Chief of Naval Operations.

The status of nuclear and non-nuclear powered submarines is in accordance with OPNAVINST 9080.2 (current edition). The status of nuclear powered surface ships is changed to "out of commission, special" vice "in service" about two weeks before trials are started.

Ships, except nuclear powered and non-nuclear powered submarines, undergoing construction, conversion or modernization at naval shipyards will be placed normally "in commission, special" prior to the conduct of INSURV at sea trials.

When a non-nuclear powered surface ship constructed, converted or modernized at a private shipyard is delivered and custody is accepted by Naval Authorities, the status automatically becomes "out of commission, special" until commissioning, except in those cases when the Fitting Out Availability (FOA) is completed during the building period, then the ship is placed "in commission."

Commissioning a ship depends upon the determination that the ship is ready in accordance with Article 0788 of U.S. Navy Regulations 1948 and that commissioning has been directed by the Chief of Naval Operations. As far as practicable, the ship at this time will be in the following condition:

1. In accordance with FOA instructions.

2. Habitable for berthing and messing.
3. Necessary firefighting, damage control, and navigational equipment on board in operating condition.
4. Control spaces and weapons batteries available to ship's company for drill and emergencies.
5. Storerooms, magazines, and magazine sprinkling systems, as required, ready for use.
6. If the FOA is to follow the commissioning of a surface ship delivered at a naval shipyard, the status is changed from "out of commission, special" to "in commission, special" at the time of commissioning. This status remains unchanged until FOA is completed.
7. The status of naval ships intended for the active fleet, regardless of the shipyard where constructed, converted, or modernized, is changed to "in commission" prior to the ship's joining the active fleet.
8. After a ship is commissioned, all changes of status will be reflected in accordance with "Movement Report Instructions" (NWIP 10-1 current edition).

Upon arrival at a shipyard to commence conversion or modernization, the commanding officer of a non-nuclear powered ship shall file a change of status to "in commission, special." The status of nuclear powered ships shall remain "in commission" throughout this shipyard period.

When determined by the Chief of Naval Operations that the status of a ship will become "out of commission, special" during the period of conversion or modernization, the following procedures apply:

1. A period of 10 to 60 days between the arrival time at the shipyard and the commencement of conversion or modernization is scheduled for the removal of all portable equipment, repair parts, initial stock lists, consumables, and other appropriate materials.
2. During the off-loading period, the crew is phased down at a rate commensurate with the amount of preparation to be accomplished by the ship's force.
3. Based upon the progress of preparations, the appropriate district commandant recommends to the Chief of Naval Operations a date for decommissioning the ship.
4. On the date approved for decommissioning, the district commandant or his designated representative places the ship "out of commission, special." (At a public shipyard, he transfers custody to the shipyard commander. At a private shipyard, he transfers custody of the ship to the Supervising Authority for delivery to the private contractor in accordance with the terms of the contract.)

Fitting Out

The fitting out period is a period of time assigned by the Chief of Naval Operations to a newly commissioned ship for the purpose of placing on board the material specified in the ship's allowance and load lists. For the ship (other than a nuclear ship) constructed or converted in a private shipyard, the fitting out period immediately follows the end of construction and commissioning of the ship. Ships built or converted in naval shipyards and nuclear ships built in private shipyards are usually fitted out in the shipyard when construction work has been completed and preliminary acceptance trials have been successfully conducted.

The fitting out period is accomplished normally at the designated fitting out activity during the FOA except that items requiring installation during the shipyard work period and items required for trials or to be on board at the time of placing "in commission" or "in commission, special" are placed on board when needed. In the case of ships carrying or serving aircraft, such aircraft and associated equipment, including aviation stores and aviation repair parts, may be placed on board during the shakedown period at the designated aeronautical outfitting assembly point. It will also include industrial work which must be necessarily performed during the FOA.

The fitting out activity is designated by the Chief of Naval Operations. The activity assembles and places the allowance list material on board (except items that were placed on board at the building or conversion shipyard or that have been specifically designated to be placed on board elsewhere). Usually a naval shipyard or other naval activity (such as a naval supply center) located within the same naval district where the ship built or converted in a private shipyard is delivered is designated as the fitting out activity for that ship. When delivery to the Navy is to be made at the private shipyard and suitable facilities are available, a ship may be authorized to be fitted out at the private shipyard where it was built or converted. When fitting out is authorized in the private shipyard, an officer of the

221

SUPSHIP office is designated to act in a liaison capacity in matters relating to the fitting out.

The Fitting Out Availability is the period of time required to effect the fitting out of a ship. The length of this period will be specified by the Chief of Naval Operations. The following is pertinent:

1. This period normally is 10 to 60 calendar days from the date of delivery when the FOA is separate from the construction/conversion/modernization activity. If special conditions render it impracticable to accomplish fitting out during this period, the Chief of Naval Operations will consider requests for extension.
2. Fitting out normally is accomplished concurrently with the shipyard work period when the fitting out activity is the same as the construction/conversion/modernization activity.
3. All shipyard work specified by the Board of Inspection and Survey for the end of fitting out (single starred work items) is completed except that which may be specifically waived by the Chief of Naval Operations.
4. The installation of all machinery, equipment, and armament should be completed, tested, and in an operable condition capable of meeting performance specifications.
5. All systems performance checkouts completed.
6. All operational and test equipment calibrated and compensated.
7. All directivity and radiation patterns determined.
8. All outfits substantially complete and on board, except the aviation outfit.
9. All essential repair parts on board.
10. All instruction books required during shakedown period on board.
11. All essential instructions, data and test equipment required for training personnel in operation and maintenance of major equipment during shakedown period on board.
12. The ship is provisioned and fueled.
13. Sufficient personnel, trained to operate the ship safely and effectively for independent operations at sea, have reported on board.

Readiness for Sea Period

Following the fitting out availability (FOA), readiness for sea (RFS) commences. This period, assigned by the Fleet Commander, varies from one to three weeks according to the requirements of each type ship. The purpose of an RFS is to provide an opportunity for a commanding officer to prepare his command for a shakedown period. This period should be dedicated for the specific purpose of ensuring that tests, alignments, calibrations, and other similar ship evolutions are completed and that the ship is, in all respects, ready for sea.

The following items are normally accomplished by the ship's crew during the readiness for sea period:

1. Calibration of degaussing equipment and deperming of the ship, if practicable.
2. Compensation of all magnetic compasses.
3. Calibration of the radar range.
4. Loading of ammunition and missiles, fuel, and provisions.
5. Completion of prescribed structural test firing of new armament, if practicable.
6. Completion of machinery performance tests.

Shakedown And Final Trials

A shakedown period is primarily intended to allow the newly commissioned ship sufficient time to complete tests, calibrations, and trials that could not be conducted or completed during the fitting out and readiness for sea periods. Tests and operations conducted at sea during shakedown frequently disclose unsatisfactory items and deficiencies that could not otherwise be detected. Any maloperations, equipment failures, or casualties occurring (including equipment deficiencies noted) during shakedown should be promptly reported to the Naval Ship Systems Command, via the type commander, with copies to the cognizant naval shipyard or SUPSHIP. Prior to the end of the guarantee period for a ship built or converted in a private shipyard, the ship must furnish a list of all defects (including those previously reported) to reach the SUPSHIP and NavShips not later than fifteen days prior to expiration of the guarantee period.

The shakedown period is assigned immediately following the readiness for sea period, if practicable. The period is specified by the fleet and type commanders who prepare and issue the necessary operation orders.

The final acceptance trials and a material inspection are conducted by INSURV or the cognizant type commander following the shakedown period and (if necessary) a restricted availability to correct deficiencies and unsatisfactory items. The final acceptance trial and material inspection are discussed in chapter 12 of this publication.

Upon final acceptance by the Secretary of the Navy, the ship is ready for unlimited operation as a unit of one of the active fleets.

A shakedown period is assigned by the Fleet Commander for each type ship and usually extends from RFS period to commencement of Post Shakedown Availability. When a Missile Ship Qualification Trials (SQT)/Special Test Period is assigned to a ship, the shakedown period commences immediately following this special period rather than after the RFS period. It is intended to complete the following as required:

1. Trials and tests not previously conducted; for example, Tactical Trials, Standardization Trials, Structural Test Firing, and Final Contract Trials.
2. Calibration of equipments and alignment of weapon systems.
3. Degaussing ranging and deperming.
4. Organization of the ship and training of the crew to the maximum attainable level of combat readiness.
5. Loading of aviation units.

SHIP INACTIVATION

Ships that are to be retained in an inactive status in the Navy reserve fleets are divided between the Atlantic Reserve Fleet and the Pacific Reserve Fleet. Ships assigned to the Atlantic Reserve Fleet are berthed in designated areas on the Atlantic and Gulf coasts. Ships assigned to the Pacific Reserve Fleet are berthed in designated areas on the Pacific coast. The inactivated ships in the reserve fleets form a reserve of sea power that is held in readiness to augment the active fleets. The primary mission of the reserve fleets is the inactivation, security, maintenance, and activation of the units assigned in accordance with the directives of the Chief of Naval Operations.

The policy of the Chief of Naval Operations is to maintain all ships of the reserve fleets in the highest practicable state of material readiness consistent with their probable mobilization employment. After the initial preservation and maintenance measures have been effected in a ship assigned to one of the reserve fleets, emphasis in all aspects of material readiness of the ship is based on the order in which the ship will be required for mobilization.

All ships assigned to the same regularly designated berthing area in a reserve fleet are organized into a RESERVE FLEET GROUP under a RESERVE FLEET GROUP COMMANDER. The group is designated by the name of the berthing area. The group commander is responsible under the appropriate reserve fleet commander for the custody, security, maintenance, and readiness (including activation and inactivation as directed) of the ships assigned his group. The Commander Atlantic Reserve Fleet and the Commander Pacific Reserve Fleet are directly under the Chief of Naval Operations.

The process of placing a ship in an inactive status consists of two phases; phase Alfa and phase Bravo. Normally, all ships being inactivated receive a phase Bravo, however, due to the stringency of funds or for other reasons, the Chief of Naval Operations may not schedule a phase Alfa for every ship designated for inactivation.

PHASE ALFA

Phase Alfa of the ship inactivation process consists of a material inspection, preinactivation trials, and a preinactivation overhaul. Preinactivation trials are discussed in chapter 12 of this publication. The engineer officer should start preparing for phase Alfa as soon as possible after his ship has been designated for inactivation. He should pay particular attention to the following:

1. Preparation of the ship's boilers for inactivation. The type commander usually schedules the operation of ships to be inactivated so as to permit cleaning, water washing, and thorough drying out of the firesides of all boilers, and to permit the boilers to be steamed a minimum of 100 hours underway prior to commencement of the inactivation period (phase Bravo).
2. Reduction of fuel oil to required limits as practicable prior to reporting for inactivation. Prior to inactivation, the fuel on board must be reduced to a maximum of 20 percent of capacity with between 10 percent and 15 percent being the optimum level.
3. Accomplishment of bilge cleaning prior to reporting for inactivation.
4. Accomplishment of ship's force work items insofar as practicable.

5. Updating of material records to ensure accuracy, currency, and completeness. Determining and recording the true material condition of the ship is a prerequisite to preparing realistic activation work specifications that provide the basis for activation and mobilization planning.

6. Placing allowance records in the best possible condition, including validation of the allowance lists in COSAL and inventories of equipment and equipage.

7. Preparation and submission to the commanding officer of a list of key engineering personnel (officer and enlisted) required to be retained until all preservation measures have been accomplished, inventory has been taken, all engineering records have been completed, and the ship has been cleaned and put in proper condition for inactivation.

During phase Alfa the ship remains in commission (or in service) and under the military, operational, and administrative command of the active fleet organization. Immediately prior to the commencement of phase Alfa, the appropriate reserve fleet commander will designate a reserve fleet group commander to inspect repairs, coordinate preparations for inactivation, and observe trials.

The phase Alfa material inspection is conducted by the cognizant type commander assisted by representatives of the appropriate reserve fleet commander. The material inspection may be waived if INSURV has conducted a material inspection of the ship within 6 months of the date the ship is scheduled to report to the reserve fleet, the type commander recommends waiving further inspection in view of the INSURV material inspection, and the reserve fleet commander concurs with the type commander's recommendation.

Preinactivation trials are conducted just prior to the preinactivation overhaul to determine the extent of necessary repairs. The overhaul, if authorized, is accomplished by a private or naval shipyard. Work to be accomplished during the overhaul includes those repairs that have been determined to be difficult or uneconomical to accomplish following inactivation and that must be completed before the ship can be properly activated and ready for sea. This work includes repairs to boilers, main propulsion machinery, propulsion shafting, propellers, steering engines, large auxiliaries, systems that require hydrostatic tests, galley equipment, and units that will be required for immediate use at the time of activation. In addition, repairs required to ensure watertightness, weathertightness, and other work beyond the capacity of the ship's force that is necessary to apply proper preservation and dehumidification will be authorized for completion at this time.

The preinactivation overhaul is not to be used to accomplish repair work solely for the following purposes:

1. Improving the appearance or habitability of the ship.
2. Completing routine maintenance or ship's force work items.
3. Calibrating or otherwise adjusting instruments, gages, electronics equipments, and other equipments that will have to be recalibrated or adjusted at the time of activation, except as required to permit testing of equipments.

Following the preinactivation overhaul, operational tests are conducted as required to demonstrate the quality of the repair work and the ability of the overhauled equipment to perform adequately and reliably. Sea trials are conducted following preinactivation overhaul when repair work has been accomplished on main propulsion equipment.

Docking the ship for underwater repairs and preservation will normally be accomplished during phase Bravo, following the completion of the preinactivation overhaul and any necessary tests or sea trials. However, under certain conditions a limited docking may be necessary to perform repair work that will require sea trials to prove satisfactory accomplishment.

PHASE BRAVO

Following completion of phase Alfa of the ship inactivation process, the appropriate reserve fleet commander will designate a berthing area for inactivation of the ship and phase Bravo commences when the ship's commanding officer reports with the ship to the reserve fleet group commander at the inactivation site. As of midnight of the day preceding commencement of phase Bravo, the ship is placed in an in commission in reserve (ICIR) status. The ship will remain in commission in reserve until at or near the completion of phase Bravo when the ship will be placed out of commission in reserve (OCIR). The cognizant reserve fleet commander will recommend a date to the

Chief of Naval Operations for placing the ship out of commission in reserve.

The ship's force is responsible for accomplishing the inactivation of the ship. The commanding officer will normally remain until the ship is placed out of commission in reserve. The executive officer, engineer officer, and other heads of departments will remain until such time as the commanding officer certifies to the cognizant reserve fleet commander that their retention is no longer required. Other officers and enlisted personnel of the engineering department will be available for detachment as necessary to stay within the interim allowances specified in OpNav Instruction 4770.5 (revised).

Except for docking of the ship and other preservation measures beyond the capacity of the ship's force, phase Bravo preservation measures can be accomplished by the ship's force in the reserve fleet berthing area. To ensure the most efficient use of available manpower, facilities, and limited funds, the reserve fleet group commander carefully screens out the ship's force work items from all requests for industrial assistance prior to submission to the SUPSHIPS or naval shipyard concerned. The industrial work is scheduled so that the period during which the ship is actually in the shipyard is kept to a minimum.

In lieu of the preinactivation overhaul, all machinery, boilers, piping, electrical apparatus, and hull fittings must be placed in the best material condition within the capacity of the ship's force, assisted by such industrial facilities as may be made available. The accomplishment of work beyond the capacity of the ship's force is accomplished in accordance with the following priority within the funds available:

1. Watertightness of the ship.
2. Weathertightness of the ship.
3. Work required to permit proper inactivation of the ship by the ship's force and personnel of the reserve fleet group.
4. Installation of dehumidification systems, cathodic protection, and other preservation systems.
5. Urgent repairs to main propulsion equipment.
6. Other urgent repair items.

The following preservation measures are generally required to be accomplished prior to completion of the inactivation period:

1. Dehumidification of the interior of the ship, including the propulsion plant on steam driven ships.
2. Cathodic protection for the underwater portion of steel hulled ships.
3. Preservation of all exterior and certain interior corrodible surfaces by the use of paint or solvent cutback preventive.
4. Preservation by special measures such as those required for sea chests, outboard shaft bearings, and other similar equipment and fittings.
5. Closure of all hull openings below the waterline by outboard blanking.
6. Installation of flooding alarm systems for main machinery spaces below the waterline of the ship.

In addition to the guidance provided by the cognizant reserve fleet group, the engineer officer of a ship being inactivated must be guided in the selection of proper preservation measures to be applied to engineering equipment, machinery, and systems (including hull fittings) by the methods prescribed in chapter 9030 (previously chapter 9) of the Naval Ships Technical Manual and other current directives of the Naval Ship Systems Command. All machinery, boilers, piping, and electrical and electronic equipments are kept completely assembled in an operable condition insofar as proper preservation measures permit.

All non-registered instruction books, manufacturer's technical manuals, records, operating logs, ship's orders, watch quarter and station bills, and all similar materials that may be of assistance during and after activation are retained in the ship or other secure storage under the cognizance of the reserve fleet group. All of the operating and maintenance records that are essential to proper activation of the ship must be brought up to date (including entries of preservation measures applied) upon inactivation.

During phase Bravo, activation work item lists must be prepared. The work lists must be complete including both industrial and ship's force work required to repair and activate the ship. One copy of the work list is submitted to the naval shipyard or SUPSHIPS assigned mobilization responsibilities for providing activation assistance.

During the inactivation process, all installed allowance list equipment must be inventoried, validated, and reported to the appropriate inventory control point. All noninstalled equipment and equipage (including repair parts) must be inventoried, validated as necessary, and retained on board except as specifically directed by the cognizant bureau and approved by the Chief of Naval Operations.

INACTIVATION INSPECTION

Upon inactivation each ship is inspected by an inspection board appointed by the cognizant reserve fleet commander. To avoid duplication of effort and when practicable, the reserve fleet commander's inspection is coordinated with the material inspection conducted by INSURV on inactivation of the ship.

The inspection board convened by the reserve fleet commander submits a report of its inspection to the Chief of Naval Operations via the reserve fleet chain of command. Copies of the inspection report are sent to the ship's type commander, to the bureaus materially concerned, to the naval shipyard commander or SUPSHIPS concerned (for mobilization planning), and to other activities as may be directed by the type commander and the bureaus concerned. The inspection report states:

1. That all actions incident to inactivation prescribed in General Instructions for the Reserve Fleets, OpNav Instruction 4770.5 (revised), have been completed (or states exceptions).
2. That required inventories have been completed.
3. That the ship will or will not require docking incident to activation and the reason(s) why.

SHIP ACTIVATION

The reserve fleet group commander is responsible under the reserve fleet commander for preparing ships of the group for return to active service. A ship that has been inactivated will not normally be returned to the active fleet until:

1. All preservation measures and materials have been removed from the ship.
2. All machinery, equipment, and systems are operable and appropriate operating tests within the facilities available has been successfully conducted.
3. All work requests for necessary repairs and modernization have been prepared, and an integrated priority list has been prepared in collaboration with the type commander and the naval shipyard or SUPSHIPS concerned.
4. Fitting out is complete within limits of the materials made available to the reserve fleet group commander.
5. A substantially complete crew has reported and the ship has been commissioned.
6. Calibrations have been made that are within the capacity of the facilities available during the process of activation.
7. Recommissioning trials have been successfully conducted.

The activation of ships of the reserve fleets under circumstances other than mobilization is accomplished in accordance with special instructions issued by the Chief of Naval Operations at the time the ship activation is ordered. The general concepts of mobilization planning and the instructions that apply to the activation of ships of the reserve fleets under mobilization conditions are explained in detail in the Ship Activation Manual, NavPers 10006 (revised).

Each reserve fleet group commander provides activation and instruction (A/I) teams to facilitate the activation of ships of the group. The A/I team is composed of trained personnel (officer and enlisted) capable of (1) commencing activation of the ship in advance of the arrival of the ship's nucleus crew, (2) guiding the ship's crew in the accomplishment of activation work, and (3) serving as underway instructors until the reserve fleet commander determines that the ship's force is competent to operate the ship underway.

The organization of each A/I team conforms to standard shipboard organization so that the team's activities will efficiently coincide with the activities of the ship's crew. The chief objective of the A/I team is to activate the ship on schedule. To accomplish this objective, a close coordination of effort between the ship's crew, the reserve fleet group, and the A/I team must be effected at an early date and maintained throughout the entire ship activation process. The function of the officer in charge of the A/I team is analogous to that of the ship superintendent in a naval shipyard in that he must maintain the work schedule and act as liaison between the reserve fleet commander and the commanding officer of the ship.

The activation work of the ship's nucleus crew is integrated with that of the A/I team. As the balance of the ship's crew arrives, the

A/I team shifts emphasis from doing activation work to instructing and furnishing technical assistance to the crew. As activation of the ship progresses, the A/I team relinquishes activation of the ship to the ship's crew. When a substantial number of the ship's crew is on board, the ship is placed in commission.

After a ship that has been activated joins an active fleet, the cognizant type commander is responsible for the following:

1. Assignment of a post activation availability, if required.
2. Final fitting out of the ship.
3. Completion of any remaining tests and calibration.
4. Shakedown and operational training.
5. Assignment of a post shakedown availability, if required.

CHAPTER 12

SHIP TRIALS

In ships of the U.S. Navy, ship trials are conducted to determine such things as performance characteristics, readiness for service, the extent of necessary repairs, the adequacy of completed repairs, and the most economical rate of performance under various conditions of service. This chapter contains information concerning the following ship trials:

1. Contract trials.
2. Special trials.
3. Pre-inactivation or pre-overhaul trials.
4. Recommissioning trials.

CONTRACT TRIALS

Contract trials are trials conducted on newly constructed and converted ships prior to acceptance of the ship by the Department of the Navy, and consist of (1) builder's trials, (2) preliminary acceptance trials, and (3) final acceptance trials. On certain ships designated by the President, Board of Inspection and Survey, a combined acceptance trial may be conducted in lieu of separate preliminary and final acceptance trials. Contract trials are intended to demonstrate that the ship is seaworthy and satisfies the operational and technical criteria established by the Chief of Naval Operations, the technical bureaus, and the shipbuilding plans and specifications. General procedures and instructions for the trials are given in the shipbuilding specifications, and in special instructions issued by the Chief of Naval Operations and by INSURV.

Conventional ships that are constructed or converted by private shipyards are operated during both the builder's trials and the preliminary acceptance trials by the contractor's personnel, subject to certain requirements contained in the specifications of the contract. The contractor, acting through the ship's master, directs the operations and is responsible for the ship. The SUPSHIP inspection officers observe and evaluate the trials. Other naval and civilian personnel of the responsible SUPSHIP office and interested bureaus attend the trials as observers and inspectors. Designated members of the nucleus crew of the ship attend the trials as unofficial observers and for training purposes.

The acceptance of a test or trial as satisfactory by SUPSHIP is indicated by the signature of the SUPSHIP inspection officer on the completed test or trial memorandum, to which is attached the data recorded by the builder during the test. The completed test memorandum with the recorded data is forwarded to the planning department of SUPSHIP for review and final approval before eventual inclusion in the Ship Information Book.

Because the ship constructed or converted in a naval shipyard is usually commissioned several months in advance of sea trials and completion of the ship, the ship's force usually operates the ship for dock and sea trials. Certain naval and civilian representatives of the shipyard and interested bureaus observe the trials. The ship superintendent of the naval shipyard observes and evaluates the trials for the shipyard commander.

For nuclear ships, the contractor (either a private or naval shipyard) conducts dock trials up to the time the reactor is made critical and the officer in charge conducts the remainder of the dock and sea trials under the supervision of the shipyard commander or SUPSHIP as appropriate. Supervision, in this sense, means sequencing, scheduling, coordination, and overall direction.

BUILDER'S TRIALS

The builder, either a private shipyard or naval shipyard, of a ship (new construction and major conversion) is required to conduct sufficient trials moored and underway (dock and sea trials) to be reasonably sure that the ship will satisfactorily meet the requirements of the contract just prior to the preliminary acceptance trial. Builder's trials also afford the private shipyard an opportunity to train personnel for the preliminary acceptance trial.

Builder's trials for a ship in a private shipyard are conducted by the contractor and are observed by representatives of SUPSHIP and the prospective commanding officer, except for nuclear ships. For submarines, the builder's trial requirements are included in the shipbuilding specifications; for other ships, the contractor determines the procedure for the trials. The severity and extent of the tests conducted are usually less than the requirements of the preliminary acceptance trial.

Dock Trials

When the installation and unit testing of all machinery in the engineering spaces are essentially complete, the builder conducts dock trials to demonstrate to SUPSHIP and the prospective engineer officer, the readiness of the ship's engineering plant for sea trials. During the builder's dock trials the following conditions must exist and the following operations must be performed (these conditions and operations are applicable to ALL dock trials):

1. The firefighting systems are completely installed, tested, and in operating condition before any fuel is placed on board.
2. All necessary alarm systems are operative.
3. The area of water in the vicinity of the ship's propeller is clear and some freedom to surge is available ahead and astern of the ship.
4. All of the ship's mooring lines are tight and camels are secured to pier pilings—NOT to the ship.
5. Stern tube packing glands are slack and cooling water is supplied to the glands in the proper amount.
6. All spring bearings are properly filled with lubricant.
7. The ship's brow has been removed.
8. Gages and safety devices are checked and final adjustments are made.
9. The main engines are operated continuously at such speeds and for such periods as the conditions at the shipyard allow. Testing of the steering equipment is conducted at the same time that the propulsion machinery is operated.
10. Propulsion machinery is operated from slow to the maximum shaft revolutions permissible alongside the pier. The machinery is operated sufficiently to permit detection and correction of installation defects and to allow wearing in of gears and bearings in preparation for the more severe operating conditions of the sea trials.
11. Each unit of machinery is inspected from the operator's normal position to determine ease and smoothness of operation; alignment; noise and vibration levels, heating of bearings and other moving parts; adequacy and cleanliness of the lubrication system; steam and oil leaks; condition of packing; and visibility of gages, thermometers, and other recording and indicating instruments.

When the dock trials or sea trials are conducted by personnel other than the ship's force, the engineer officer should arrange to have his operators observe the operations at the watch stations that they will be expected to man after the ship is commissioned. Dock and sea trials afford an excellent opportunity for training operators. When acting as observers, ship's force personnel must not interfere with the operation of the trial.

Sea Trials

The builder's sea trials, conducted as soon after the builder's dock trials as practicable, are required to determine that the ship is seaworthy and that all its machinery and equipment are ready for the preliminary acceptance trials. Sea trials are necessary in order to demonstrate the proper operation of electronics installations (such as air search radar, fire control radar, sonar, and similar equipments) that require a land-free area and deep water in which to operate. All tests that cannot be performed with the ship moored are accomplished during the builder's sea trials.

During the builder's sea trials, the following conditions must exist and the following operations should be completed:

1. All temporary rigging used in the installation of machinery is removed from engineering spaces.
2. The bilges are clean and the eductor or bilge suction system has been satisfactorily tested.
3. Certificates of calibration for all pressure gages, torsion meters, thermometers, pyrometers, switchboard instruments, and other

essential power measuring and indicating equipment, boiler safety valve settings, relief valve settings, reducing valve settings, speed limiting device and overspeed trip settings (as applicable) are furnished SUPSHIP by the contractor.

4. Adjustments of the ship's magnetic compass are made. Compass adjustments must be for normal undegaussed deviations unless otherwise specified.

5. The ship's auxiliary equipment and units are tested and operated. Thorough operational tests of all electronics and weapons equipment are conducted.

6. The ventilation and air conditioning systems are operated and tested for satisfactory operation, including tests for balance, capacities, and compartment temperatures.

Upon completion of the builder's sea trials, SUPSHIP or the shipyard commander (as appropriate) immediately notifies INSURV of the results of the trials and of any deficiencies or discrepancies (including lack of operable equipment) that cannot be corrected in time for the preliminary acceptance trials.

PRELIMINARY ACCEPTANCE TRIAL

The preliminary acceptance trial is witnessed by INSURV or an INSURV Regional Board or Sub-Board. The trial is conducted to determine whether the ship is constructed or converted in accordance with the contract specifications. In accordance with its findings the INSURV Board authorizes preliminary acceptance of the ship for restricted service, or requires an additional trial at a later date when specific deficiencies have been corrected. The Board's authorization to accept delivery may be conditional pending completion of certain work items prior to delivery. When acceptance is conditional, the INSURV Board generally delegates to SUPSHIP or the shipyard commander (as appropriate) the authority for determining that the work items are completed and for notifying the accepting authority of that fact whenever it is impracticable or unnecessary for the Board to make a return inspection.

Periodically, prior to the preliminary acceptance trial, the prospective engineer officer or engineer officer should submit to the prospective commanding officer or commanding officer a list of work items of incomplete or unsatisfactorily completed work, and a list of alterations or improvements which he considers essential to the mission of the ship. The work items are discussed in conference with SUPSHIP or the shipyard commander (as appropriate) and the following disposition is made:

1. The items determined to be the builder's responsibility within the terms of the plans and specifications are referred to the shipyard for appropriate action. If not completed prior to the preliminary acceptance trial, the items are carried as contractor responsible trial work items.

2. The items contrary to the provisions of the plans and specifications involving a change in design, affecting the military characteristics of the ship, involving significant weight and moment changes, or otherwise considered major changes, are referred back to the prospective commanding officer or commanding officer to be submitted officially to the Naval Ship Systems Command as alteration requests or to be covered in the trial report as alterations requested by the ship.

3. The items within the scope and intent of the plans and specifications but not detailed therein, that are minor in nature and do not affect the military characteristics of the ship or involve significant weight, space, or moment changes, are referred to the shipyard for consideration. If the shipyard is not prepared to accomplish the items, the ship may submit the items to the INSURV Board as trial work items or as alterations requested by the ship.

Immediately prior to the preliminary acceptance trial the responsible SUPSHIP office or the planning department of the naval shipyard compiles the list of trial items for submission to the INSURV Board. The items reported for consideration by the Board include unsatisfactory items observed (including the items submitted by the ship) during construction or conversion, testing, inspections, and earlier trials.

The preliminary acceptance trial includes comprehensive operating tests witnessed by the INSURV Board, as well as a material inspection conducted by the Board, to determine conformance of the ship with the contract requirements. INSURV instructions 9080.2 (Revised) and 9080.3 outline the tests and demonstrations required for the preliminary acceptance trial, and the Board may prescribe other tests and demonstrations as the circumstances warrant. The trials and tests conducted may include:

1. Full power trial.
2. Quick reversals and backing trial.
3. Boiler overload test.
4. Locked shaft test.

230

5. Steering ahead.
6. Steering astern.

During or immediately following the trial and material inspection, INSURV (in conference with representatives of interested bureaus, the ship, and the contractor) passes on the trial items submitted, officially classifies each item in accordance with INSURV Instruction 4730.11, and adds any items resulting from the Board's observations and inspections.

Following completion of the preliminary acceptance trial, the senior member of the INSURV Board, on the basis of the results of the trial (including the material inspection), the seriousness of the work recommended, and the advice of SUPSHIP or the shipyard commander concerning the time required to accomplish the work items required by the end of construction or conversion, determines whether to authorize delivery and preliminary acceptance of the ship as of the scheduled end of the construction or conversion period or another date. When, in the opinion of the Board, the extent of the deficiencies requires an additional trial following their correction, the senior member of the Board directs SUPSHIP or the shipyard commander to recommend a new date for the additional trial and a new delivery and acceptance date.

When INSURV determines that the material deficiencies existing in the ship substantially reduce her fitness for naval service but are not of such magnitude to warrant rejection of the ship, INSURV may recommend conditional acceptance of the ship for restricted service. The restricted service limitations may be removed when the material deficiencies have been corrected to the satisfaction of the cognizant type commander and have been approved by the Chief of Naval Operations, or, under special circumstances, when a waiver has been requested by the cognizant type commander and approved by the Chief of Naval Operations.

FINAL ACCEPTANCE TRIAL

The final acceptance trial of the ship (including a material inspection) is normally conducted by INSURV six months after preliminary or conditional acceptance of the ship and prior to the end of the guarantee period. The object of the trial is to determine if there is any material weakness, defect, failure, breakdown, or deterioration (other than that resulting from normal wear and tear) through the fault of the contractor that has not been corrected. The cost of remedying defects and deficiencies that have not been corrected by the contractor will be deducted in the final settlement of the contract for ships built in private shipyards.

The final acceptance trial is conducted by the ship's force under the supervision of the INSURV Board and in accordance with the requirements of the contract. The trial will normally include a full power trial. As soon as practicable following the trial, a careful and thorough examination is made of such parts of machinery as INSURV may designate. The examination may be conducted by the engineer officer of the ship or by members of the Board. When the examination is made by the engineer officer, he reports the results of the examination to the commanding officer, who forwards the report (with comments and recommendations) to INSURV and to the Naval Ship Systems Command. The work necessary to correct defects or deficiencies must be completed as soon as practicable after the trial.

If INSURV finds the ship is acceptable, the President, Board of Inspection and Survey recommends to the Secretary of the Navy that the ship be finally accepted as of a certain date. For ships constructed or converted at a private shipyard, the date of final acceptance usually coincides with the date of the expiration of the guarantee period or any extension thereof. If there are defects affecting the ship's readiness for unrestricted service, INSURV recommends such corrective action as may be appropriate. Upon final acceptance by the Secretary of the Navy, the ship is assigned operations with the fleet.

In preparation for the final acceptance trial, the ship's force must prepare a work item list (for submission to INSURV) of work required by the contract and specifications (including authorized changes therein) that was unfinished at the preliminary acceptance trial, or subsequently authorized, that is not yet satisfactorily completed.

The engineer officer must ensure that the following reports, test data, and publications are available for inspection by the INSURV Board members immediately upon their arrival:

1. Correspondence concerning waivers for uncompleted work.
2. *Damage Control Book.*
3. *Ship Information Book.*
4. Report of watertight integrity tests conducted during building or conversion.
5. *Naval Ships Technical Manual.*
6. Test memoranda.

7. Test agenda.
8. Docking report (with a copy for the Board).
9. Damage control diagrams.
10. Docking plan.
11. Booklet of General Plans.

SPECIAL TRIALS

The Naval Ship Systems Command requires that special trials be conducted on one ship from a class of new-construction or major-conversion ships to determine various characteristics of the class. The results of the trials supply the data for the development of operational information furnished to all ships of the class. The trials may also be of an experimental nature not related to class performance, but conducted for the purpose of obtaining specific data for design purposes. Special trials may be conducted on ships not considered as new construction or major conversion to determine the effect of the installation of newly designed equipment, such as a propeller or rudder. In addition to miscellaneous experimental trials and tests, special trials include standardization trials, tactical trials, plant efficiency trials, vibration trials, and noise trials. All of these trials require the installation and operation of special instruments and are conducted by experienced technical personnel.

The Naval Ship Systems Command selects the ship for special trials and submits a letter to the Chief of Naval Operations outlining the scope and duration of the trial and requesting that the ship be made available for conducting the trials. When the ship is made available, the cognizant type commander makes arrangements with the Naval Ship Systems Command for conducting the trials. NavShips prepares and issues to all participating activities an agenda outlining the procedure for the trials and assigning responsibility for preparing the ship, conducting the various trials, preparing trial reports, and removing test equipment upon completion of the trials. Preferably, members of the engineering department of the ship act as engineering observers and record data during the trials.

STANDARDIZATION TRIALS

For the standardization trials, the ship selected for the trials is operated over a suitable measured trial course at both heavy and light displacement in order to determine the ship's speed, shaft rpm, shaft thrust, and shaft horsepower characteristics. With the data obtained from the runs, standardization curves for the displacement conditions of the trials are prepared and issued to all ships of the same class, and to interested fleet and shore activities.

The trials consist of runs over a measured course at sufficient speeds to yield rpm, shaft horsepower, and thrust versus ship's speed data that will ensure accurate standardization curves. Combatant ships make runs in increments of 3 knots, from 12 knots to full power; auxiliary ships in increments of 2 knots, from 8 knots to full power. Three consecutive runs, alternating in direction at as nearly the same shaft rpm as possible, are made for each speed. Each series of runs must be uninterrupted and performed in sequence. The rpm of the various shafts should not vary more than two percent for any one speed. The average of any individual run of a speed group should not vary more than two percent from either of the other two runs of the same group.

The ship's draft, trim, and displacement must be determined before the start and at the completion of the trial runs. From these data the average draft, trim, and displacement is computed to determine the displacement conditions existing during the trial. Unless otherwise directed in the trial agenda, the ship is loaded so that the runs are conducted with the trim as close to zero as possible.

Standardization trials should not be conducted when weather conditions require excessive use of the rudder to maintain the ship on course, or when the effect of the wind or sea is sufficient to materially affect the results of the trial. Additional conditions for the standardization trials are prescribed in the Naval Ships Technical Manual and in the trial agenda. The ship's underwater log should be calibrated concurrently with standardization trials.

TACTICAL TRIALS

The tactical trials (unless otherwise specified in the trial agenda) consist of operational procedures to determine characteristics of the ship relative to normal turning circles, acceleration and deceleration in a straight path and maneuvering, and special turns. Observations during the trials are made from stations aboard ship and ashore. Suitable locations for the observation stations ashore are prescribed in the trial agenda; the Naval Ship Systems

Command will furnish personnel and instrumentation for the trial. The Command will also analyze the data obtained and prepare them for distribution. The observations made will consist of simultaneous bearings taken at equal time intervals, beginning at a prearranged signal from the ship. The Naval Ship Systems Command will furnish personnel and instrumentation for these trials and will analyze and prepare the data obtained for distribution.

The normal turning circle trials consist of complete circles in one direction at several speeds up to full power, using a range of rudder angle up to full rudder. Constant throttle settings are maintained throughout each circle. For single shaft ships, the circles are repeated in the opposite direction. For multi-shaft ships, one check turn is made in the opposite direction, at various speeds and using a specified rudder angle. If the results of the check turn indicate that turning characteristics for equal speeds and rudder angle do not vary appreciably, no further turns in the opposite direction are required.

Acceleration characteristics of the ship are determined from data obtained as follows:

1. Acceleration of the ship in a straight path at the maximum rate practicable from "dead in the water" to a specified ahead speed, the maximum rate practicable being the rate at which the throttles may be opened without dropping the main steam pressure (at the throttle) below the established minimum operating pressure.
2. Acceleration of the ship in a straight rate practicable from a specified fractional, steady ahead speed to full power ahead.

Deceleration characteristics of the ship are determined from data obtained by successive decelerations from various ahead speeds under steady steaming conditions down to "dead in the water" with the engine throttles set at "back full" as in answer to the order "all engines back full." Results are expressed to show the instantaneous speed obtained at equal time intervals.

PLANT EFFICIENCY TRIALS

To determine the efficiency of the propulsion plant of a representative ship, the Naval Ship Systems Command may conduct certain plant efficiency trials. Because there are a great number of different types of propulsion plants in naval ships, the detailed trial procedure will depend on the type of propulsion plant installed in the representative ship and will be prescribed in the trial agenda.

In steam-driven ships, main turbine water-rate and/or heat balance trials may be scheduled in addition to fuel economy trials. Trial runs of a major combatant ship, with the engineering plant cross-connected, are conducted at various speeds from approximately 10 knots to the speed corresponding to one-half the total number of boilers installed operating at 20 percent overload capacity (the other boilers secured). Next, with the operation of the engineering plant split, the trial runs are made at various speeds from about 20 knots to full power. For slower ships, the speeds of the trial runs are correspondingly lower. Where various engine combinations are possible in diesel-driven ships or ships with combined propulsion plants, fuel economy trials will include trial runs to determine the most efficient engine combination.

Fuel data obtained during the plant efficiency trials are plotted directly on the standardization trial curves. The data represent the performance characteristics of the ship under ideal conditions and should not be used for logistics purposes.

NOISE TRIALS

The procedures for conducting noise trials in the representative ship are prescribed in the trial agenda for the ship. The trials conducted generally include one or more of the following surveys or tests:

1. Airborne Noise Surveys—conducted in certain compartments to determine the character of the noise and the remedial action required to reduce the noise to acceptable limits. The surveys of airborne noise may include tests to determine: (1) the source and magnitude of noise due to ventilation and air conditioning systems as well as its effects on operating equipment and personnel in such vital spaces as the plotting centers; (2) the cause of main propulsion noise and its effect on operating personnel; and (3) the interference of airborne noise with announcing systems, telephones, audible signal devices, and general conversation.
2. Underway Radiated Noise Trials—conducted to determine the character and magnitude of the noise radiating underwater from the ship under various operating conditions.
3. Self Noise Trials—conducted to determine the interference of the ship's noise with its sonar equipment.

4. Overside Noise Tests—conducted to determine the character of noise radiating underwater from individual equipment installed throughout the ship.

5. Structural Borne Noise Trials—conducted to determine the source and path of transmission of machinery vibrations to the water.

VIBRATION TRIALS

The procedures for conducting vibration trials in the representative ship are prescribed in the trial agenda for the ship. The trials conducted may include one or more of the following tests:

1. Hull Vibration Tests—conducted to determine the character of vibrations in the hull structure resulting from propeller and wave action.
2. Propulsion System Vibration Tests—conducted to determine longitudinal and torsional vibration characteristics of the ship's propulsion elastic system (the combination of the main engine, reduction gear, foundation, shafting, shaft bearings, and propeller).
3. Component, System, and Structure Vibration Tests—conducted to determine the character and source of local vibrations in specific units, systems, and structures.

PRE-INACTIVATION TRIALS AND RECOMMISSIONING TRIALS

Immediately prior to arrival in a shipyard for inactivation or a regular overhaul where extensive repairs are required or a major alteration is to be accomplished, the ship should conduct a full power trial for at least one hour or such other trials as may be necessary for the purpose of determining the actual condition of the ship, the operating condition of the engineering plant, the exact character of certain defects, and the full extent of repairs or alterations necessary to improve efficiency or to restore the ship for further service. When practicable, the trials should be conducted during the pre-arrival inspection to allow the ship superintendent (naval shipyard) or ship surveyor (SUPSHIP) and other interested shipyard or SUPSHIP personnel to witness the trials so they can secure the detailed information necessary to facilitate the preparation of job specifications or job orders and cost estimates.

The pre-inactivation or pre-overhaul trials are conducted by the commanding officer. The ship's engineer officer must ensure that a full description of the condition of the machinery and equipment, and the repairs or alterations found necessary as a result of the trials, is properly entered in the ship's maintenance records.

Recommissioning trials are conducted on a ship being returned to active status after having been inactivated. The trials are usually conducted by the commanding officer after the commissioning of the ship. They include a dock trial and a sea trial, and are conducted for the following reasons:

1. To evaluate inactivation maintenance measures.
2. To determine if the engineering plant can adequately meet the full power requirements.
3. To test the adequacy of the repairs and alterations accomplished during activation.
4. To evaluate standard methods of preservation.
5. To familiarize the engineering crew with the procedures for operating the machinery under full power.

The dock trials for a ship being activated are conducted in the same manner as that previously described for the builder's dock trials, and the same conditions and operations apply. Prior to and after the dock trial (and all other trials conducted by the commanding officer) the engineer officer is responsible for the inspection and testing of main engines, boilers, reactors, auxiliary machinery, piping systems, and all appliances necessary for the proper operation of the engineering plant. The inspections and tests must be made as prescribed in the manufacturer's technical manuals, operating guides, and applicable chapters of the Naval Ships Technical Manual.

When the ship is being activated in a naval shipyard, the shipyard commander, as soon as practicable after the engineer officer of the ship reports for duty, directs the ship superintendent to conduct the dock trials in conjunction with the ship's engineer officer and to submit the trial reports to the commander. Any defect, deficiency, or maladjustment discovered during the dock trial must be corrected, supplied, or remedied by the shipyard upon receipt of the trial report by the shipyard commander, and another trial must be made.

The commanding officer of a ship that has been activated is required to conduct sea trials as soon as practicable after the ship is commissioned. The commanding officer will not conduct the sea trials, however, until the engineer officer assures him that the engineering crew has had sufficient experience to operate the engineering plant under full power. The procedure for conducting the full power phase of the recommissioning sea trials is the same as that previously described for the full power trial in chapter 8 of this publication.

As soon as possible after a ship is commissioned, the commanding officer is required to obtain the ship's initial steaming characteristic data necessary for determining the most economical speed of the ship and the fuel consumption for each engine mile steamed under varying conditions of service. Having obtained these data under conditions of smooth water and a comparatively clean ship's bottom, further trials under different conditions of sea, bottom, and displacement may be made whenever practicable. Data thus obtained are recorded and reported on the standard engineering trial report forms described in chapter 8 of this publication and available for issue as indicated in the Navy Stock List of Forms and Publications, NavSup 2002. Reports of the ship's steaming characteristic data are submitted to the Chief of Naval Operations.

At the discretion of the type commander and when the ship is operating in the vicinity of a suitable, measured trial course, the commanding officer should conduct sufficient standardization trials to maintain the ship's standardization data current and consistent with the condition of the ship's bottom and any other variables affecting the operating characteristics of the ship. The following data should be recorded for the standardization runs:

1. Displacement of the ship (tons).
2. Drafts (forward and aft).
3. Number of days out of dock.
4. Ship's speed (knots).
5. Shaft rpm (each shaft).
6. Shaft horsepower (indicated horsepower or kilowatts developed by plant, as appropriate).

A copy of the data obtained for the standardization trials conducted by the ship's force should be forwarded to the Naval Ship Systems Command for information. The report should contain a statement by the engineer officer stating the method used for determining rpm and shaft horsepower.

INDEX

Academic Training, 66
AC/DC Electrical Propulsion Operating Record, 103
Administrative Department, 198
Administrative Services Superintendent, 200
AEL, 135
Airborne Noise Surveys, 229
Air Compressor Operating Record, 106
Allowance Division, 201
Alteration, Definition of, 187
Arrival Conference, 190
Arrival Inspection, 54
Assistant Contract Officer, 201
Assistant Material Officer, 201
Assistant Planning Officer, 200
Assistants to Engineer Officer, 7-10
Auxiliaries Division, 19
Availability, Definition of, 186

Board of Inspection & Survey, 172-175
  INSURV Material Inspections, 172-175
  INSURV Surveys, 175
Boat Fueling Record, 110
Boilermaker, 17
Boilerman, 18
Boiler Room Operating Record, 101
Boilers Division, 19
Boiler Tube Casualty Report, 118
Boiler Tube Renewal Sheets, 118
Boiler Water Treatment Logs, 118
Builder's Trials, 224

Civilian Personnel Offices, 198
Classification of Ships, 146
Command Duty Officer, 25
Compartment Checkoff List, 33
Concurrent Availability, Definition of, 186
Construction Plans, 214
Contract Administration Division, 201
Contract Department, 201
Contract Guidance Plans, 213
Contract Plans, 213
Contract Trials, 224
  Builder's Trials, 224
    Dock Trials, 225
    Sea Trials, 225
  Definition of, 224
    Final Acceptance Trial, 227
    Preliminary Acceptance Trial, 226
Controlled Equipage Procedures, 153-155
  Equipage Stock Card & Custody Record, 153
  Inventory of, 154
Corrective Maintenance, 77
COSAL, 133
Cycle Schedule, 79

Daily Fuel and Lube Oil Account, 108
Daily Watch Account, 108
Damage Control, 31-52
Damage Control Assistant, 7, 35
Damage Control Bills, 40
Damage Control Library, 39
  Damage Control Book, 39
  Other Publications, 40
Damage Controlman, 18
Damage Control Organization, 31-39
  Damage Control Assistant, 35
    Prevention Phase Responsibilities, 35
    Repair or Recovery Phase Responsibilities, 36
    Department Heads Responsibility, 31
    Repair Party, 37
Deferred Actions, 87
Degaussing Folder, 115
Departmental Budgets, 158
Department Heads, Responsibility, 31
Departure Report, 210
Detachment Duties, Engineer Officer, 11
Diesel Engine Operating Record, 101
Directives, Definition of, 28
Distilling Plant Operating Records, 106
Division Officers, Duties, Responsibility & Authority of, 13-15
Division Training Officer, 15, 58

236

INDEX

Dock Trial, 209
Dock Trials, 225

Educational Service Offices, 57
EIC Manual, 85
Electrical Division, 20
Electrical Log, 101
Electrical Officer, 8
Electrician's Mate, 18
Electronic Failure Report, 128
Electronics Installation Record, 128
Emergency Ratings, 6
Emergency Tender Availability, Definition of, 186
Engineering Administrative Assistant, 8
Engineering Casualty Control, 51
  Manual, 51
  Plot, 52
Engineering Casualty Control Manual, 51
Engineering Department, 12-30
Engineering Department Duty Officer, 26
Engineering Divisions, 19
  Auxiliaries Division, 19
  Boilers, 19
  Electrical, 20
  Main Engines, 20
  Repair, 20
Engineering Log, 97-99
Engineering Material, 131-159
Engineering Officer Responsibilities, 31, 35
Engineering Personnel, 13-28
  Division Officers, 13-15
  Division Training Officer, 15
  Engineering Divisions, 19
  Enlisted Personnel, 16-19
  Junior Division Officer, 15
  Technical & Material Assistant, 16
Engineering Practices, General Procedure, 160-163
Engineering Practices, Good, 160-166
  Safety Precautions & Operating Instructions, 163
  Securing Schedules, 164
  Warming Up Schedules, 164
Engineering Readiness Trials, 166
Engineering Standards, 160-175
Engineering Training Office, 9, 58
Engineer Officer, 1-11
Engineer Officer's Night Order Book, 113
Engineer's Bell Book, 99
Engineman, 18
Enlisted Personnel, 16-19
  Firemen, 17
  Petty Officers, 17-19
Enlisted Training, 74
Equipage Stock Card & Custody Record, 153
Expenditure of Material, 155-157
  Surveys, 155
    Report of, 157
    Types of, 155-157
  Transfer, 155

Final Acceptance Trial, 227
Financial Control of Ship's OPTAR, 157-159
  Fund Codes, 158
  Departmental Budget, 158
Financial Division, 201
Fire Marshal, 10
Firemen, 17
Fleet Training, 53-56
  Shakedown & Refresher Training, 54-56
    Arrival Inspection, 54
  Type Training Exercises, 53
    Fleet Training Groups, 54
    FTG Instruction, 55
Formal Survey, 155
Format for Functional Guide, 6
Fuel & Water Accounts, 108-113
  Boat Fueling Record, 110
  Daily Fuel & Lube Oil Account, 108
  Daily Water Account, 108
  Fuel & Water Report, 108
  Fueling Memorandum, 110
  Liquid Load Plan, 110
  Oil King's Memorandum, 113
Fuel & Water Report, 108
Fueling at Sea, 178-184
  Delivering Fuel Oil, 180
  Emergency Breakaway, 181-184
  Receiving Fuel Oil, 179
  Transferring Gasoline and JP-5, 184
Fueling Memorandum, 110
Fueling Ship, 176-185
Fuel Oil Stowage, 177
Functional Training, 74
Fund Codes, 158

Gas Free Engineer, 9
Gasoline Stowage, 176
General Ratings, 16
Gyrocompass Operating Record, 106

Head Design Engineer, 200
Head of Engineering Department, 2
  Assistants to, 7-10
  General Duties, 4

- Head of Engineering Department—continued
  - Responsibilities, 31-35
  - Specific Duties, 4-7
- Home & Planning Shipyards, 196

- IC Room Operating Record, 106
- Identification of Materials, 132-145
  - Allowance Equipage List (AEL), 135
  - Cognizance Symbols, 132
  - COSAL, 133
  - Federal Stock Numbers, 132
  - Identification Publications, 133
    - Allowance Lists, 133
  - Material Control Code, 132
  - NavSup Publications, 143
- Inactivation Inspection, 222
- Informal Survey, 156
- In-Port Watches, 25-28
  - Command Duty Officer, 25
  - Engineering Department Duty Officer, 26
  - Engineering Watches, 27
- Inspection Division, 201
- Inspections & Tests, 41-46
- Instructors, 59
- INSURV Surveys, 175
- Interior Communications Electrician, 18

- Junior Division Officer, 15

- Leadership Training, 65
- Legal Records, 97-99
  - Engineer's Bell Book, 99
  - Engineering Log, 97-99
- Liquid Load Plan, 110
- Long-Range Training Schedule, 68

- Machinery Repairman, 18
- Machinists Mate, 18
- Main Engines Division, 20
- Main Propulsion Assistant, 7
- Main Propulsion Turbine Condition Report, 130
- Maintenance Data Collection Subsystem, 85-94
  - Equipment Identification Code (EIC) Manual, 85
  - MDCS Documentation 85-94
- MDCS Documentation, 85-94
  - Deferred Actions, 87
  - Forms, OPNAV Series, Description of Entries on, 93
  - Shipboard Maintenance Actions, 86
  - Work Request, 88
- Maintenance Requirement Cards, 182
- Manhour Accounting System, 94
- Material Conditions of Readiness, 34
- Material Department, 201
- Material Division, 201
- Material Officer, 201
- MDCS Documentation, 85-94
- Military Training, 61
- Milstrip Requisitions, 150
- Miscellaneous Records & Reports, 113-130
- Monthly Summary, 113

- Naval School Training Program, 73-75
  - Enlisted Training, 74
  - Functional Training, 74
  - NESEP, 74
  - Officer Training, 73
- Naval Shipyards, 191-197
  - Alteration Requests, 197
  - Home & Planning Shipyard, 196
  - Ship Superintendent, 195
  - Shops, 193
  - Task & Functions of, 191
  - Work Requests, 197
- NavSup Publications, 143
- Navy Enlisted Scientific Education Program, 74
- NBC Defense Officer, 9
- NESEP, 74
- New Construction and Major Conversions, 211-219
  - Nucleus Crew, 212
  - Shipbuilding Procedures, 213-219
- Noise Trials, 229
- Notices, Navy, 29
- NRT Ship Availability, Definition of, 186
- Nucleus Crew, 212

- Officer Training, 73
- Oil King's Memorandum, 113
- Oil Pollution Acts, 184
- Onboard Plans, 214
- Operating Records, 99-107
  - AC/DC Electric Propulsion, 101
  - Air Compressor, 106
  - Boiler Room, 101
  - Diesel Engine, 101
  - Distilling Plant, 106
  - Electrical Log, 101
  - Gyrocompass, 106
  - IC Room, 106

Operating Records—continued
    Propulsion Steam Turbine, 101
    Refrigeration/Air Conditioning Equipment, 106
Operational Training, 64
Order, Military, Definition of, 28

Parent Tender/Automatic Availability, Definition of, 186
Performance Standards, 166-172
    Engineering Readiness Trials, 166
    Readiness Inspections, 169-172
Petty Officers, 17
Phase Alfa, 219
Phase Bravo, 220
Planned Maintenance Subsystem, 77-85
    Corrective Maintenance, 77
    Maintenance Schedules, 79
    PMS Manual, 77
    Preventive Maintenance, 77
Planning and Estimating Officer, 200
Planning and Process Control Division, 201
Planning Assistant, 200
Planning Department, 200
Planning Officer, 200
Plant Efficiency Trials, 229
PMS Feedback Report, 84
PMS Manual, 77
Policy Military, Definition of, 28
Post Repair Trials, 209
Practical Factors, Group Record, 62
Pre-Inactivation Trials, 230
Preliminary Acceptance Trial, 226
Preventive Maintenance, 77
Procedure, Military, Definition of, 28
Production Plans, 214
Professional Training, 61
Proposal Evaluation Division, 201
Propulsion Steam Turbine Operating Record, 101
Prospective Engineer Officer, 10

Quality Assurance Department, 200
Quality Assurance Officer, 200
Quarterly Schedule, 80
Quarterly Training Plan, 68

Radiological Defense, 46
    Emergency Phase, 46
    Recovery Phase, 46
Readiness for Sea, 210
Readiness Inspections, 169-172
    Administrative Inspection, 169
    Material Inspection, 170
    Operational Readiness Inspection, 170-172
Recommissioning Trials, 230
Records & Reports, 96-130
Refrigeration/Air Conditioning Equipment Operating Record, 106
Regular Overhaul, 203-210
    Advance Planning, 204
    Assist - Ship's - Force Funds, 205
    Departure Report, 210
    Docking, 205-208
    Inclining Experiments, 208
        Administrative Department, 209
        Planning Department, 209
        Production Department, 209
        Purpose of, 208
        Post Repair Trials, 209
    Readiness for Sea, 210
Regular Overhaul, Definition of, 186
Regular Tender Availability, Definition of, 186
Repair Activities, 187-203
    Naval Shipyards, 191-197
    Repairs & Alterations, 187-189
    Repair Ships & Tenders, 189-197
    Ship's Force Maintenance & Repairs, 189
    Supervisor of Shipbuilding, 197-203
Repair, Definition of, 187
Repair Division, 20
Repair Party, 37-39
Repair Parts Procedures/Procurement, 146-153
    Classification of Ships, 146
    NIS/NC Transactions, 149
Repairs & Alterations, 187-189
Repair Ships & Tenders, 189-197
    Arrival Conference, 190
    Checking Progress of Tender Repair Jobs, 190
    Ship-to-Shop Jobs, 190
    Work Requests & Job Orders, 190
Restricted Availability, Definition of, 186

Sea Trials, 225
Selected Record Plans, 214
Self-Noise Trials, 229
Service Ratings, 16
Shakedown and Refresher Training, 54-56
Ship Activation, 222
Shipboard Administrative Organization, 3
Shipboard Maintenance Actions, 86

239

- Shipboard Training Program, 56-73
  - Organization for Training, 56
    - Division Training Officer, 58
    - Educational Services Officer, 57
    - Engineering Training Officer, 58
    - Instructors, 59
    - Planning Board for Training, 57
  - Training Records, 66, 73
  - Types of, 60-66
- Shipbuilding, Inactivation & Activation, 211-223
- Shipbuilding Procedures, 213-219
  - Completion & Commissioning, 216
  - Construction Stage, 215
  - Fitting Out, 217
  - Readiness for Sea Period, 218
  - Shakedown & Final Trials, 218
  - Ship Plans, 213-215
- Shipbuilding Supervisor, 197-203
  - Departments & Functions, 198
  - Organization of Office, 198
- Ship Characteristics Cards, 124
- Shipfitter, 18
- Ship Inactivation, 219-222
  - Inspection, 222
  - Phase Alfa, 219
  - Phase Bravo, 220
- Ship Maintenance, 76-95
- Ship Plans, 213
- Ship's Bills, 29
  - Administrative, 29
  - Emergency, 29
  - Operational, 29
- Ship Superintendent, 195
- Ship Trials, 224-231
- Situation Reports, 129
- Special Trials, 228-230
  - Noise Trials, 229
  - Plant Efficiency Trials, 229
  - Standardization Trials, 228
  - Tactical Trials, 228
  - Vibration Trials, 230
- Standardization Trials, 228
- Standard Plans, 214
- Standard Ship Organization, 1
- Steaming Orders, 115
- Submarine Project Offices, 200
- Supply Availability, Definition of, 186
- Supply Overhaul, 145
- Support Availability, Definition of, 186
- SUPSHIP Procedures, 202
- Surface Ship Coordination, 200

- Tactical Trials, 228
- Technical & Material Assistant, 16
- Technical Availability, Definition of, 186
- Training, 53-74
- Training Program, Naval School, 73
- Training Records, 66-73
- Trials, 224-230
- Trouble Call Record, 115
- Type Plans, 214
- Types of Material, 131

- Underway Watches, 21-25
  - Damage Control Watch, 24
  - Damage Control Watch Officer, 22
  - Engineering Officer of the Watch, 24
  - Engineering Watches, 25
  - Officer of the Deck, 22

- Vibration Trials, 230

- Watch Organization, 20-28
  - Underway Watches, 21-25
- Watertight Integrity, 41
- Weekly Schedule, 80
- Weekly Training Schedule, 70, 72-73
- Working Plans, 214
- Work Requests, 88

- Yeoman, 19